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An Economic Study of Dairying on 149 Farms in Broome County, New York



A THESIS

PRESENTED TO THE FACULTY OF THE GRADUATE SCHOOL OF
CORNELL UNIVERSITY FOR THE DEGREE OF
DOCTOR OF PHILOSOPHY

BY

EDWARD GARDNER MISNER

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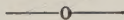
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AN ECONOMIC STUDY OF DAIRYING ON 149 FARMS IN BROOME COUNTY, NEW YORK

E. G. MISNER

The rapid growth of the milk trade, increases in the cost of milk production, and advances in the price of milk to consumers, have made the economic problems concerned in the production, transportation, and distribution of market milk of increasing public concern. This bulletin is

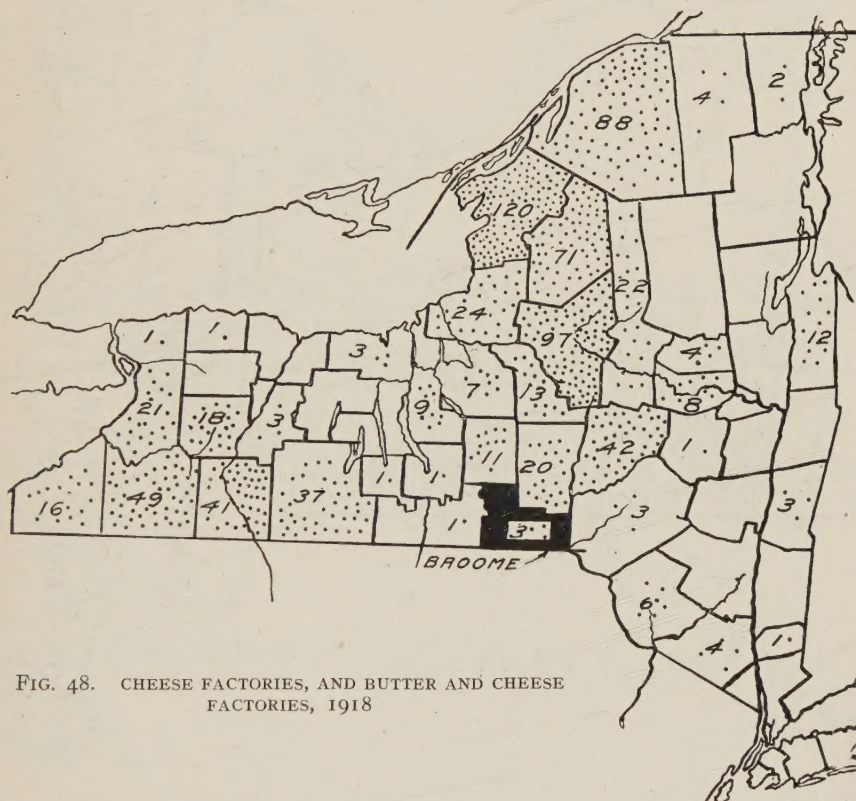


FIG. 48. CHEESE FACTORIES, AND BUTTER AND CHEESE FACTORIES, 1918

a report of a cost study, concerned only with the problems of production, not with those of transportation or distribution. The costs in terms of dollars are out of date because prices have changed, but the quantities are not affected so much by price changes.

AUTHOR'S ACKNOWLEDGMENTS. The dairymen of Broome County, New York, furnished the production data for this study. The investigation was under the direction of Professor G. F. Warren, of the Department of Agricultural Economics and Farm Management, New York State College of Agriculture. Professor E. S. Savage, of the Department of Animal Husbandry, advised for that part of the study relating to feeding. Professor K. C. Livermore gave criticisms and helpful suggestions. E. R. Minns assisted the writer in doing the field work. To these and to all others who helped with the work, the writer is indebted.

During July and August, 1915, in cooperation with the Broome County Farm Improvement Association, data concerning the dairy business for the year ending May 1, 1915, were obtained from 149 farmers in Broome County.

The exact figures for the pounds of milk delivered to the milk stations and the amount paid were obtained for each farm from the companies buying the milk. Some farmers kept no record of milk sold, and thus

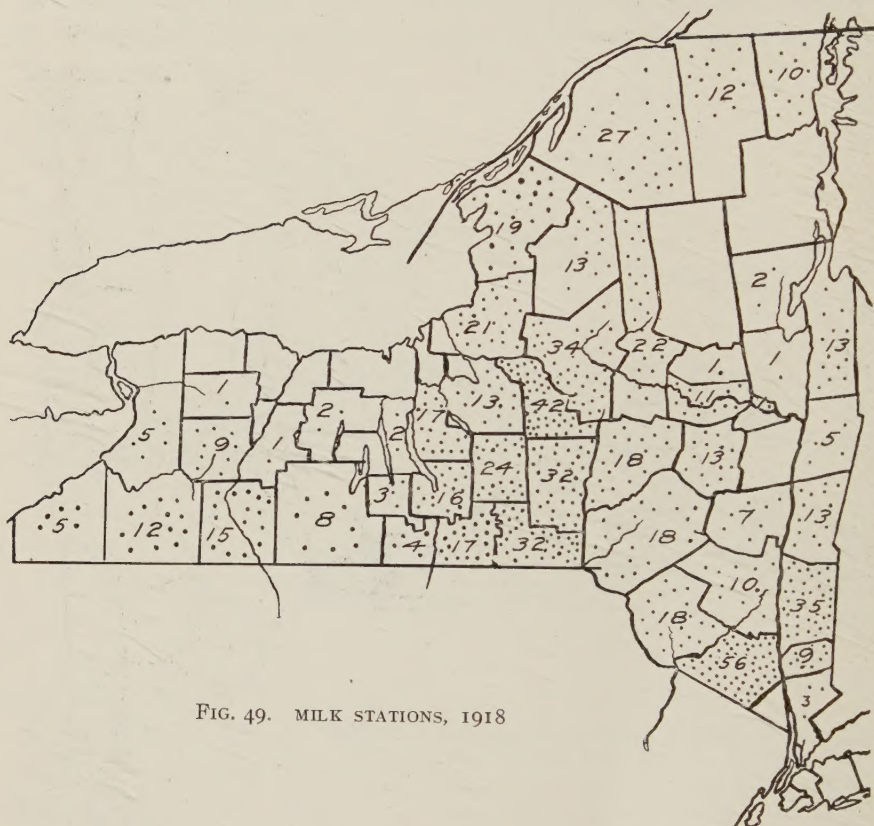


FIG. 49. MILK STATIONS, 1918

the necessity of accepting estimates as to the sales of milk was eliminated. For 114 farms, the average butterfat test of the milk by months was given by the companies. Other information was obtained from the farmers. Care was taken to obtain complete and fair estimates.

The form of blank for summarizing records in this office is shown on pages 440 to 443.

REGIONAL CONDITIONS

Broome County is one of the southern border counties of New York State. It is bounded on the east by Delaware County, on the west by Tioga County, on the north by Chenango and Cortland Counties, and on

the south by the State of Pennsylvania. It contains 705 square miles, 85 per cent of which is in farms. In 1920, according to preliminary returns for the fourteenth United States census, the population was 113,610. Binghamton, near the center of the county, the county seat and the only city of importance, had a population of 66,800. Three railroad lines — the Delaware, Lackawanna and Western, the Erie, and the Delaware and Hudson — serve the county. Binghamton furnishes a fair market

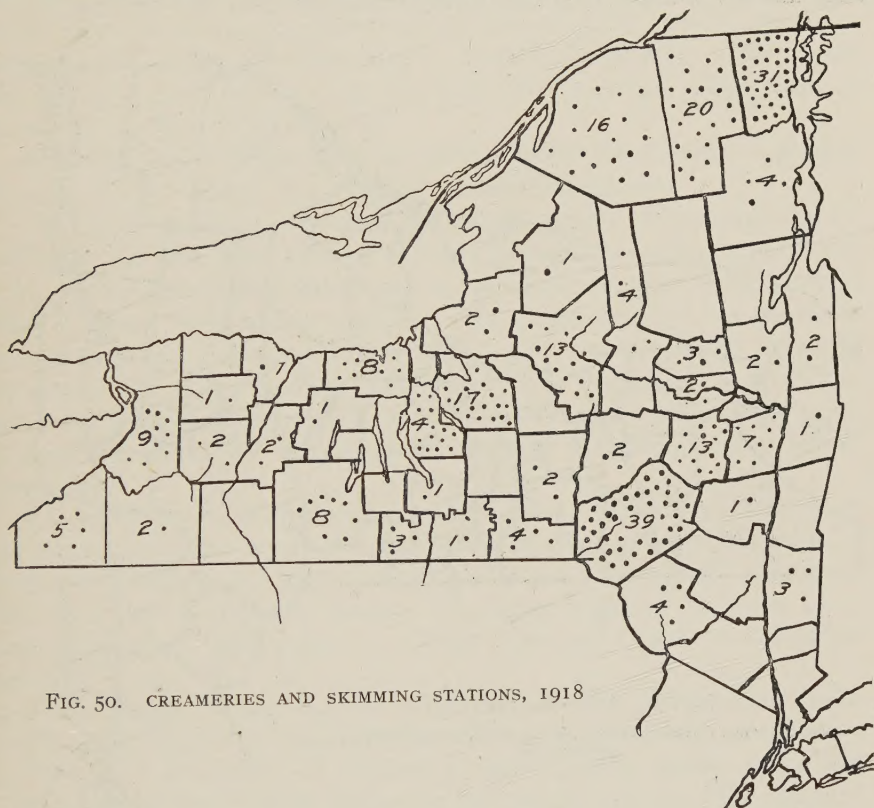


FIG. 50. CREAMERIES AND SKIMMING STATIONS, 1918

for a considerable amount of farm produce. Most of the surplus is shipped to New York City, 207 miles by rail.

The topography of Broome County is that of a feebly glaciated plateau region, thru which streams have cut deep valleys. Besides many small streams, three rivers of considerable size intersect the county, the Otselec joining the Tioughnioga at Whitney Point in the northern part, the Tioughnioga joining the Chenango at Chenango Forks, and the Chenango joining the Susquehanna at Binghamton. These river valleys are from one-half mile to almost two miles wide, and lie at an elevation of about 800 to 900 feet.

The valley soils are mapped as of the Chenango and Genesee series.¹ They are by far the more productive soils of the county, altho in some places adjacent to the rivers they are so low that crops are sometimes damaged or destroyed by floods out of season.

The land back from the valleys is rolling to steep. Much of the area is in woods, and a large proportion is suitable only for grazing. The highest elevations are in the southern part of the county, where the average level of the hilltops is about 1500 feet, altho the highest point is over 2000 feet.

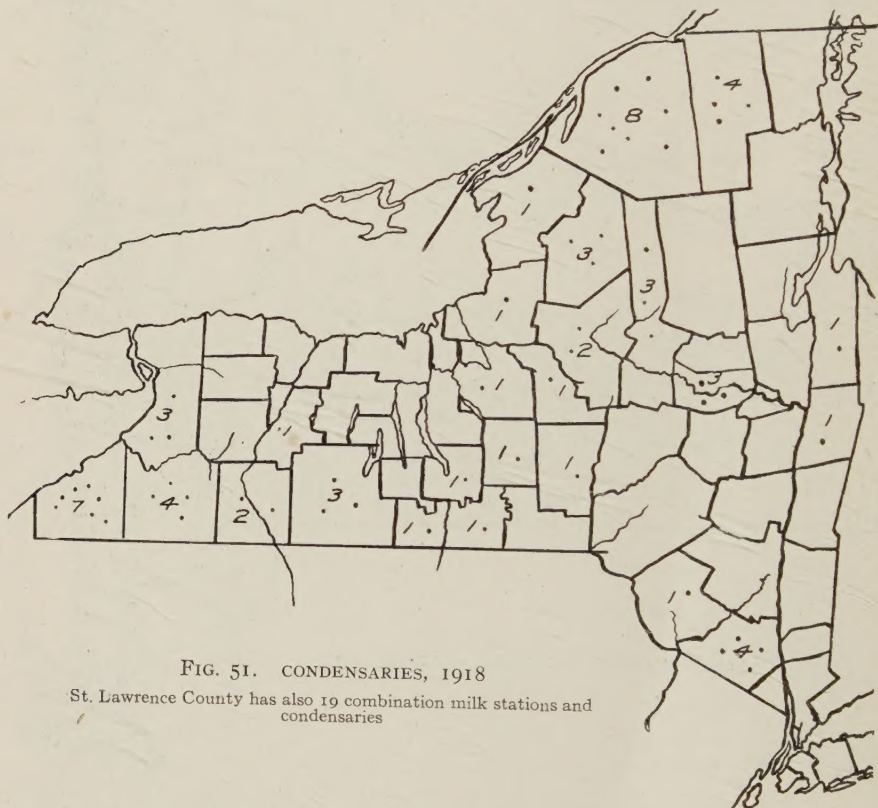


FIG. 51. CONDENSARIES, 1918

St. Lawrence County has also 19 combination milk stations and condensaries

Aside from small areas of alluvial soils in the stream valleys, the upland soils are generally of one type, Volusia silt loam. This is the most extensive and least productive type in the county. Its distinguishing characteristics are low humus content and low lime content. The compact subsoil or rock, generally lying close to the surface, makes drainage conditions unfavorable to the best crop production.

Weather records give the mean annual temperature at Binghamton, 871 feet above sea level, for the years 1890 to 1916 inclusive, as 46.8° F.,

¹ Field operations of the Bureau of Soils. United States Agr. Dept. Report 11:71-96. 1905.
Soils of the United States. United States Soils Bureau. Bul. 96:744. 1913.

and the average rainfall as 33.18 inches. About half of the rain, 15.61 inches, falls from April to August inclusive. Much of the summer rainfall comes in heavy showers which quickly run off, and drouths are somewhat frequent, so that pastures often need to be supplemented during August and September.

The average length of the growing season at Binghamton for the years mentioned was 150 days.² The average date of the last killing frost in the spring was May 6, and of the first killing frost in the fall October 3. Altho there are no weather records for the uplands of this county, the growing season there averages from two to three weeks shorter. This makes the pasture season shorter, and the frost injury to crops, particularly to corn, more extensive, on the hills.

There are three types of farming common in Broome County — general farming, dairy farming, and trucking for the local markets.

Most of the trucking is confined to the valleys near the principal towns, while general and dairy farming is found both in the valleys and on the hills. The farms on the Volusia soil are devoted primarily to the production of forage crops and to dairying. On a few, potatoes are grown as a cash crop, but in general the land is too poor and the season too short to grow other intensive crops. The distance to market is much greater from the farms on the uplands, and this factor also influences the type. Everything considered, dairying is the best type of farming for the upland conditions.

According to the thirteenth census the average farm in the county in 1910 contained 102 acres. Of this, 35 acres were in crops exclusive of fruit, 22 in woods, and 45 in pasture and other land. Of the crop land, 27 acres were in hay and forage. The other principal crops are corn, oats, buckwheat, and potatoes. These crops are typical of the farms studied.

Altho Broome County may be considered a leading dairy county of the State, many dairymen, especially those of the uplands, follow an extensive system. An abundance of pasture, a short growing season, and a soil that is not naturally fertile, encourage the summer system. The industry never has been so intensively developed here as it has in the neighboring counties of Delaware and Chenango, or in many other counties of the State. This may be due mostly to less productive soil.

During the past thirty years the system of dairying has become increasingly more intensive. In 1880 there were 29,398 dairy cows two years old or older on farms in the county, and 3,659,982 pounds of butter made on farms.³ In 1917 there were 27,029 dairy cows on 3027 farms in the county, an average of 8.9 per farm reporting dairy cows.⁴ The

² Climatological data, New York section, August, 1916, page 94.

³ United States census report, 1880.

⁴ Census of the agricultural resources of New York, 1917.

United States census of 1910 reported 410,291 pounds of butter made on farms in the county during 1909. In 1900 there were twenty milk stations in the county, and in 1916 there were forty.⁵

The making of butter and cheese has practically ceased. This has resulted in more winter milk. The next step in the development of a more intensive system of dairying in the region will be the production of

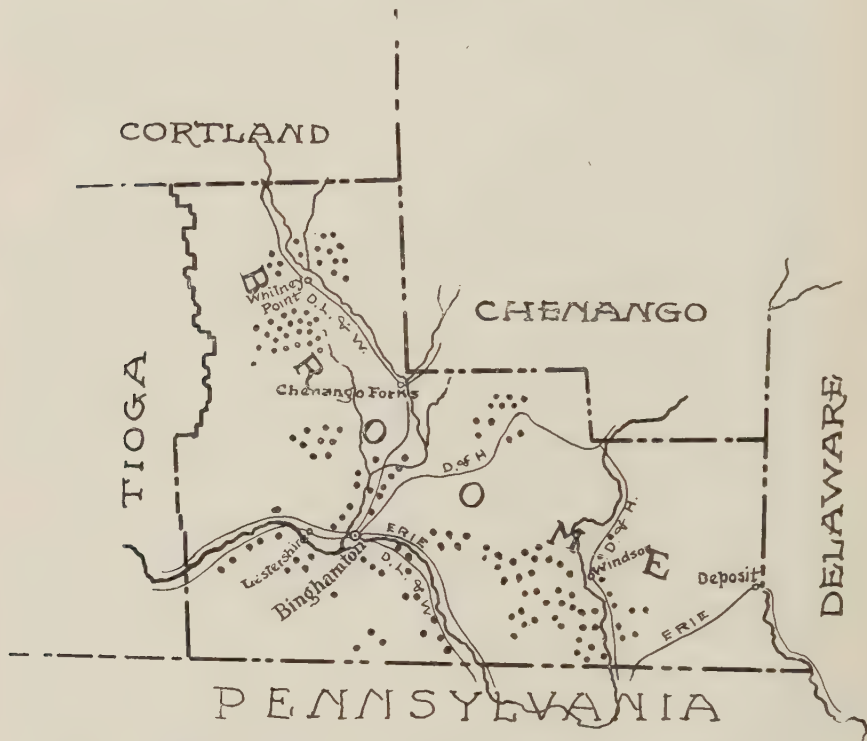


FIG. 52. MAP OF BROOME COUNTY SHOWING LOCATION OF FARMS STUDIED

Of the 149 farmers, 104 owned all of the land they farmed, 6 owned part and share-rented additional land, 12 owned part and cash-rented additional land, and 20 share-rented and 7 cash-rented all of the land they farmed. The average number of acres per farm was 157, and the average distance to market was 3.4 miles. The average age of the farmers was 47 years.

a still larger proportion of the milk in winter, as the demands of Binghamton and New York City for market milk continue to grow.

The farms included in this survey were in various parts of the county, but most of them were in the vicinity of Windsor, Whitney Point, and Binghamton. Fifty were in the Susquehanna, Chenango, and Otsego Valleys, and ninety-nine were on the hills or upland. Herds of less than six cows were not included, but other than this there was no selection.

⁵ Bulletin 5, New York State Department of Agriculture, pages 4-5, 1900, and Bulletin 88, New York State Department of Agriculture, pages 3, 4, and 5, 1916.

RESULTS OF THE INVESTIGATION

For convenience the results of this study are arranged in five parts. Part I considers the entire dairy enterprise as the unit of study; Part II deals with cows only, Part III with heifers, Part IV with herd bulls, and Part V with veals and bulls to be sold.

PART I. CONCERNING THE ENTIRE ENTERPRISE

When the entire dairy enterprise is considered the unit, all the costs of maintaining cows, costs of growing and maintaining heifers, calves, veals, bulls to be sold, and herd bulls, costs of marketing dairy products, and any other costs for dairy cattle, are charged. All returns from the enterprise are credited and the difference is considered the gain or loss on the enterprise.

The dairy is only one of the various parts of a farm business, and therefore the results do not show the gain or loss on the whole farm. An investigation that included the labor income as well as costs and returns for the dairy would be useful.

Costs

The various costs chargeable to dairy cattle may be classified as follows: feed, bedding, labor, milk hauling, use of buildings, use of equipment, interest, and miscellaneous charges.

Feed

No account was taken of feed given to stock other than dairy cattle. The total quantities and costs of the various feedstuffs used by all dairy cattle, by cows during the pasture period, by heifers, by herd bulls, and by bulls raised to be sold, were obtained separately in the field. The feed used by cows during the winter period was considered to be the difference between the total herd quantities and the other quantities.

All grain, succulent feed, and forage raised on the farm and used by cattle, was charged at what it would sell for at the farm, that is, its market value less the cost of marketing. All feedstuffs purchased were charged at the prices paid. The cost of hauling to the farm was included with labor, equipment, milk hauling, and other costs. Much of the purchased grain is hauled home by the farmer when returning from delivering the milk. This was included with the charge for milk hauling. Extra trips for feed, as well as the time spent hauling home-grown grains to and from the mills and the time spent mixing feed, was charged under labor.

Grain and other concentrates.—With grain and other concentrates were included all concentrated feedstuffs, namely, all grains and their by-products whether home-grown or purchased, calf meal, condimental feeds, and salt (table 1). The charge for grain represented 36 per cent of the total feed cost and 20 per cent of the total cost of the enterprise.

On the 149 farms there were six different kinds of grain raised and fed cattle, and at least forty-three different kinds of grain purchased and fed.

TABLE I. CONCENTRATES USED BY 2058 COWS, 1002 HEIFERS, 172 HERD BULLS, AND 76 BULLS TO BE SOLD*

Kind of feed	All herds			Cows			Heifers			Herd bulls			Bulls to be sold				
	Num-ber of herds using feed	Number of pounds used	Average price per ton†	Value	Number of pounds used	Per cent, of com- binational feed and salt	Average price per ton	Value	Num-ber of herds using feed	Number of pounds used	Value	Num-ber of herds using feed	Number of pounds used	Value	Num-ber of herds using feed	Number of pounds used	Value
Home-grown:																	
Oats.....	42	88,950	\$30.92	\$1,375	69,507	2.46	\$30.01	\$1,043	23	17,729	\$302	9	1,714	\$30			
Buckwheat.....	17	27,430	33.60	462	25,220	0.89	33.54	423	2	1,970	35	1	240	4			
Corn.....	7	14,140	27.44	194	13,640	0.48	27.13	185					300	9			
Rye.....	1	2,800	44.29	62	2,240	0.08	44.64	50	1	560	12		50				
Barley.....	1	1,700	35.29	30	1,260	0.05	35.20	22	1	400	7		50	1			
Wheat.....	1	360	44.44	8					1	310							
Total home-grown.....	....	135,380	\$31.48	\$2,131	111,857	.....	\$30.81	\$1,723	....	20,969	\$363	....	2,554	\$45	....	....	....
Purchased:																	
Gluten (feed).....	134	1,113,480	\$30.38	\$16,916	1,072,005	37.92	\$30.36	\$16,274	44	31,315	\$470	43	10,160	\$172			
Cornmeal.....	60	160,490	32.28	2,590	125,440	4.44	32.27	2,024	33	25,095	405	32	9,955	161			\$16
Hominy.....	9	28,020	30.76	431	20,495	0.72	30.35	311	6	5,705	92	3	720	12	1	1,100	
Corn and oats.....	8	8,400	35.24	148	90		22.22	1	8	7,250	128	3	1,060	19			
Corn bran.....	1	2,850	7.72	11	2,850	0.10	7.72	11	....	....	....	....	....	....	....	....	....
Corn middlings.....	1	1,880	18.09	17	1,880	0.07	18.09	17	....	....	....	....	....	....	....	....	....
Wheat feed.....	72	422,907	30.84	6,521	363,936	12.87	30.84	5,612	50	48,451	747	36	10,520	162			
Wheat bran.....	65	262,700	28.52	3,746	235,235	8.32	28.56	3,359	38	21,975	308	28	5,490	79			
Red dog middlings.....	33	19,200	32.92	316	7,650	0.27	30.59	117	2	10,815	186	7	635	11	1	100	2
Buckwheat middlings.....	2	700	34.29	12	....	....	....	....	....	....	....	....	....	....	....	....	....
Ground oats.....	6	25,300	30.99	392	25,090	0.88	31.04	388	1	300	4	3	1,900	33			
Whole oats.....	5	8,200	33.90	139	3,400	0.12	31.76	54	1	700	13	1	100	2			
Whole meal.....	1	800	37.50	15	....	....	....	....	....	....	....	....	....	....	....	....	....
Cottonseed meal.....	67	186,975	32.74	3,061	180,141	6.37	32.73	2,948	11	5,321	87	14	1,513	26			
Oilmeal.....	44	15,200	42.37	322	7,660	0.27	45.43	174	31	7,130	139	7	410	9			
Distillers' and brewers' dried grains:																	
Continental gluten.....	4	22,000	33.18	365	21,560	0.76	33.49	361	....	....	....	2	440	4			
Dewey's.....	8	36,400	32.91	599	35,650	1.26	32.93	587	1	600	10	1	150	2			
Kinds not found.....	6	12,500	32.96	206	11,480	0.41	32.93	189	1	720	12	1	300	5			
Dry equivalent of brewers' grains, wet.....	2	60,206	15.28	460	60,206	2.13	15.28	460	....	....	....	....	....	....	....	....	....
Brewers grains, dried.....	25	89,800	28.00	1,257	88,655	3.14	28.02	1,242	4	800	10	5	345	5			
Malt sprouts.....	2	5,000	25.60	64	5,000	0.18	25.60	64	....	....	....	....	....	....	....	....	....

* The number of bulls to be sold is the number born during the year, plus the number purchased, less the number slaughtered or sold for slaughter.

† Average prices per ton are obtained by dividing the total value by the quantities used.

TABLE I (concluded)

Kind of feed	All herds				Cows				Heifers			Herd bulls			Bulls to be sold		
	Num-ber of herds using feed	Number of pounds used	Average price per ton	Value	Number of pounds used	Per cent, omitting con-dimental feed and salt	Average price per ton	Value	Num-ber of herds using feed	Number of pounds used	Value	Num-ber of herds using feed	Number of pounds used	Value	Num-ber of pounds used	Value	
Molasses and molasses feeds:																	
Molasses	8	9,900	\$23.64	\$ 117	9,900	0.35	\$23.64	\$ 117	7	5,680	\$ 75	10	2,230	\$30	...	...	
Cloverhay Feed	17	80,600	26.18	1,055	72,690	2.57	26.14	950	1	370	5	1	170	2	...	...	
Hammond's Dairy	2	11,200	26.61	149	10,660	0.38	26.64	142	...	...	...	...	...	...	...	...	
Ideal	1	10,000	25.00	125	10,000	0.35	25.00	125	...	...	...	...	...	...	...	...	
International Special	1	10,000	22.00	110	10,000	0.35	22.00	110	...	...	...	...	...	...	...	...	
Purina	1	8,000	33.00	132	7,850	0.28	33.12	130	1	150	2	...	...	...	...	...	
Sucrose	2	5,600	30.71	86	5,600	0.20	30.71	86	...	...	...	...	...	...	...	...	
Xtra Vin	2	2,500	32.80	41	2,500	0.09	32.80	41	...	...	...	...	...	...	...	...	
Empress	1	2,000	23.00	23	2,000	0.07	23.00	23	...	...	...	...	...	...	...	...	
International Dairy Feed	1	30,500	24.98	381	28,000	0.99	24.93	349	1	2,200	28	1	300	4	...	...	
Sugar Feed	1	2,600	30.00	39	2,600	0.09	30.00	39	...	...	...	...	...	...	...	...	
Kind not found	24	106,760	25.96	1,386	103,059	3.65	25.95	1,337	6	2,961	39	5	740	10	...	...	
Other mixed feeds:																	
Eggee	4	27,800	24.82	345	25,740	0.91	25.02	322	2	1,580	19	2	480	4	...	...	
Schumacher	32	68,450	31.56	1,080	43,875	1.55	31.23	685	22	22,000	354	10	2,375	41	...	...	
Union grains (Ubiko)	3	49,000	32.65	800	48,900	1.73	32.64	798	...	...	...	...	...	...	...	...	
Unicorn	7	43,300	33.86	733	39,920	1.41	33.87	676	1	2,500	42	2	880	15	...	...	
Mixed feed (Ubiko)	1	20,000	32.00	320	...	...	...	...	1	17,400	278	1	2,000	42	...	...	
Grandin's Mixed Feed	6	8,975	31.42	141	4,300	0.15	32.09	69	2	4,525	70	1	150	2	...	...	
Kind not found	1	2,800	33.57	47	2,800	0.10	33.57	47	...	...	...	...	...	...	...	...	
Miscellaneous:																	
Dried beet pulp	7	16,400	27.07	222	16,300	0.58	27.12	221	1	100	1	...	...	...	...	...	
Calif meal	63	16,150	59.07	477	...	...	...	...	63	14,574	426	21	1,426	46	4	150	\$5
Alfalfa meal	1	100	40.00	2	100	0.01	40.00	2	...	...	...	...	...	...	...	...	
Conifederal feed	32	21,350	...	326	1,350	...	...	324	1	...	...	1	...	...	...	...	
Salt	141	70,110	10.36	363	67,480	...	...	349	8	2,430	13	...	200	1	...	...	
Total purchased	...	3,087,103	\$29.86	\$46,088	2,783,957	100.00	\$29.55	\$41,135	...	246,147	\$4,027	...	55,649	\$903	1,350	\$23	
Total concentrates	...	3,222,483	\$29.93	\$48,219	2,895,814	...	\$29.60	\$42,858	...	267,116	\$4,390	...	58,203	\$948	1,350	\$23	

† Quantities reported for six farms only. On the others the quantities were too insignificant to note. Probably some of this expense should have been included under miscellaneous costs, as medicines, and so forth.

The usual practice is to buy all the grain. Only 53 farms raised any grain to feed cattle. Practically all of this was oats and buckwheat. Purchased grain represented 96 per cent of the quantity used, and at the average price of \$29.86 a ton it represented also 96 per cent of the charge for grain used by dairy cattle. The average value of home-grown grain used was \$31.48 a ton.

Succulent feed.—Silage, green corn, potatoes, cabbage, cabbage fodder, mangels, beets, turnips, carrots, apples, soiling crops, skim milk purchased, and other feeds with a very high percentage of water, were classed as succulent feed. Brewers' grains wet were converted to their dry equivalent by considering 3.8 pounds of wet grains equal to 1 pound of dried grains, and were charged under grain rather than under succulent feed. Quantities, costs, and the number of farms using each kind of succulent feed, are given in table 2.

Corn silage was charged at \$5 a ton. Under some conditions, the market value of silage should be used when charging it to another enterprise; but generally, in New York State, corn for the silo is not raised to be sold either as grain or as silage, and hence it should be charged at cost. There is no reason to believe that the cost of producing silage on the farms studied was less than this figure.

Of the 149 farms, 69, or 46 per cent, fed silage. On these farms, 4284 tons of corn silage and 20 tons of millet silage were fed dairy cattle. An agricultural census of the State taken in 1917 showed that 3027 farms in Broome County kept dairy cows and 1033 grew corn for the silo in 1916; thus, about one-third of the farms with dairy cows grew silage.

Other succulent feeds were charged at their estimated farm values. Of all the herds, 26, or 17 per cent, fed no succulent feed. Excepting 21.8 tons of skim milk and 1.35 tons of potatoes purchased, all succulent feed was raised on the farms where fed.

Dry forage.—All hay, corn stover, straw, and other cured roughage was classed as dry forage. One per cent was purchased. Of this, 11 farms bought 42.75 tons of hay, and two other farms bought 12 tons of cornstalks. The amount fed to dairy cattle per farm was 35.4 tons, of which mixed hay constituted 63 per cent. The average value of dry forage per ton was \$9.62. Details as to quantities, costs, and number of farms using each kind of dry forage, are given in table 3.

Pasture.—Most farms had sufficient pasture for their cattle. Of the 149 farmers, 45 paid \$793 to pasture some of their cattle a part or all of the season, and 20 received \$305 for stock taken in.

Pasture was charged at cost. In determining this cost, interest at 5 per cent and taxes at 0.5 per cent were charged on the value of the land pastured. Charges for labor and materials used in making and repairing pasture fences, in manuring when manure was hauled and applied, in fertilizing, reseeding, mowing brush or weeds, or in any other treatment

TABLE 2. SUCCULENT FEED USED BY 2058 COWS, 1002 HEIFERS, 172 HERD BULLS, AND 76 BULLS TO BE SOLD

Kind of feed	All herds			Cows			Heifers			Herd bulls			Bulls to be sold		
	Num-ber of herds using	Num-ber of tons used	Average price per ton	Value	Num-ber of tons used	Average price per ton	Value	Num-ber of herds using	Num-ber of tons used	Value	Num-ber of herds using	Num-ber of tons used	Value	Num-ber of herds using	Num-ber of tons used
Home-grown:															
Corn silage.....	69	4,284	\$ 5.00	\$21,420	3,895.9	\$ 5.00	\$19,484	45	310.1	\$1,548	39	78	\$388	...	...
Millet silage.....	1	20	3.00	60	20	3.00	60	...	5	15	...	...	3	...	...
Corn (green).....	50	417.75	2.68	1,118	411.95	2.67	1,100	...	5	...	...	...	...	...	...
Sweet corn.....	2	7	4.00	28	7	4.00	28	...	...	...	...	0.8	...	...	...
Turnips.....	20	126.65	4.67	592	106.35	4.29	456	...	...	134	...	0.8	...	...	...
Potatoes.....	36	70.73	7.20	509	70.03	7.21	505	...	2	2	...	1	...	...	...
Mangels.....	3	47.4	3.04	144	46.4	3.06	142	...	0.25	1	...	0.45	...	...	...
Carrots.....	3	7.6	10.79	82	7.6	10.79	82	...	1	1	...	0.5	...	...	...
Apples.....	1	4.8	4.17	20	4.8	4.17	20	...	...	...	...	...	...	...	...
Beets.....	2	0.5	10.00	5	0.5	10.00	5	...	...	...	...	...	...	...	...
Cabbage fodder.....	7	57	1.89	108	57	1.89	108	...	...	...	...	...	...	...	...
Cabbage.....	6	30.75	3.02	93	30.75	3.02	93	...	...	...	...	...	...	...	...
Green rowen.....	2	36	1.81	65	36	1.81	65	...	...	...	...	...	...	...	...
Millet.....	8	28	4.21	118	27.7	4.22	117	...	...	...	...	0.3	...	...	...
Oats and peas.....	2	27.5	3.24	89	27.5	3.24	89	...	1	1	...	1	...	...	...
Buckwheat.....	6	14	7.71	108	14.0	7.71	108	...	...	...	...	...	...	...	...
Oats, corn, and millet.....	1	9	3.00	27	9.0	3.00	27	...	...	...	...	...	...	...	...
Oats.....	1	2	5.00	10	2.0	5.00	10	...	...	...	...	...	...	...	...
Rye.....	1	1.5	5.33	8	1.5	5.33	8	...	...	...	...	...	...	...	...
Purchased:															
Skim milk.....	21	21.8	3.53	77	...	...	...	...	21	18.69	64	5	6	2	1.72
Potatoes.....	1	1.35	3.70	5	1.35	3.70	5	...	...	...	...	1.39	6	2	1.72
Total succulent feed.....	...	5,215.33	\$4.73	\$24,686	4,777.33	\$4.71	\$22,512	...	354.04	\$1,764	...	82.24	\$403	...	...

TABLE 3. DRY FORAGE USED BY 2058 COWS, 1002 HEIFERS, 172 HERD BULLS, AND 76 BULLS TO BE SOLD

Kind of feed	All herds			Cows		Heifers		Herd bulls		Bulls to be sold			
	Num-ber of herds using	Number of tons used	Average price per ton	Value	Number of tons used	Average price per ton	Value	Num-ber of herds using	Num-ber of tons used	Value	Num-ber of herds using	Num-ber of tons used	Value
Home-grown:													
Mixed hay	130	3,322.9	\$10.28	\$34,158	2,571.3	\$10.27	\$26,414	117	608.5	\$6,262	101	143.1	\$1,482
Timothy hay	35	557.5	10.84	6,046	445.95	10.82	4,826	22	86.0	931	17	24.65	278
Clover hay	7	103	11.63	1,198	86.9	11.50	999	3	14.4	177	2	1.7	22
Clover hay (second cut)	8	36.5	11.73	428	20.1	12.29	247	5	13.9	155	2	2.5	28
Alfalfa	11	45.5	14.33	652	42.4	14.34	608	4	7.75	61	4	1.7	14
Oat hay	24	140.5	9.08	1,276	131.05	9.16	1,201	4	7.75	61	4	1.7	14
Oat and pea hay	20	137.0	9.40	1,288	125.2	9.33	1,168	5	10.1	103	2	2.95	30
Millet	18	106.0	9.13	968	87.8	9.02	782	5	15.25	146	3	2.95	30
Straw fed (oat)	22	62.5	4.86	304	53.75	4.91	264	8	7.15	35	4	1.6	5
Straw fed (buckwheat)	5	4.5	4.22	19	3.65	3.84	17	1	0.5	3	1	0.35	2
Corn stover	72	706.5	5.61	3,963	680.2	5.60	3,699	28	39.55	232	13	6.75	32
Purchased:													
Hay	11	42.75	10.88	465	42.75	10.88	465	.....	.....	.....	.....	.....	.....
Corn stalks	2	12	2.08	25	12.0	2.08	25	.....	.....	.....	.....	.....	.....
Total dry forage	.....	5,277.15	\$9.62	\$50,790	4,283.05	\$9.51	\$40,722	.....	806.10	\$8,146	.....	187.10	\$1,911
	.....							.....			.....	0.9	\$11

of the pasture, and money paid for the use of pasture, were included. The amount received for stock taken in to pasture was deducted to get the cost of pasturing the farmer's own stock. This cost on each record was apportioned to cows, heifers, herd bulls, horses, and sheep, on the animal-unit basis and according to the number of days pastured. Most of the pasture hired was for heifers and the amount paid was charged directly to them.

The average date of turning out in the spring was May 14, and that of beginning full barn feeding in the fall was October 19. This allowed an average of 159 days on pasture. The dates of turning out varied from May 1 to June 1. The dates of beginning to feed in the fall varied from September 15 to November 15. Usually the meadows were pastured after the hay was removed. They furnished considerable feed, especially on the river flats. For this no charge was made, altho such a charge should have been included. In late summer and early fall, pasture was frequently supplemented by grain or fodder or both. The dry matter in the feed used supplementary to pasture for cows was equivalent to the dry matter in ten days of winter feed. On this basis pasture furnished 149 days of full feed for cows.

An average of 53.2 acres to each farm was pastured. Since the average size of farm was 156.7 acres, 34 per cent of the land was in pasture. The average value was \$20.25 an acre. On the average 3.1 acres were pastured per animal unit.

The cost of pasture was \$4.83 per cattle unit for the season, or 3.04 cents a day. Of this, interest and taxes comprised 72 per cent, and fencing costs 20 per cent. The balance was cash paid for hired pasture and other miscellaneous items. The charge for stock taken in to pasture was at the rate of \$6.30 an animal unit for the season, or about 4 cents a day.

A summary of pasture costs is given in table 4. Stock pastured, and the distribution of the cost of pasture, are given in table 5.

TABLE 4. COST OF PASTURE, 2018 COWS, 607 HEIFERS, 106 HERD BULLS, 199 SHEEP, AND 124 HORSES AND COLTS

7,927.5 acres of pasture land at \$20.25 = \$160,509

Item	Farms having expense	Cost
Interest and taxes at 5.5 per cent.	149	\$8,828
Making and repairing fences.	147	2,395
Mowing and reseeded.	5	69
Fertilizing and manuring.	2	165
Amount paid for pasture rented.	45	793
Total.		\$12,250
Received for pasture.	20	305
Difference (= cost of pasture).		\$11,945

TABLE 5. STOCK PASTURED, AND DISTRIBUTION OF PASTURE COST

Kind of stock	Number of farms pasturing	Number of animals pastured	Average number of days pastured to each farm pasturing	Equivalent in animal units for entire season	Amount charged
Stock owned:					
Cows.....	149	2,018	159	2,018.5	\$9,338
Heifers.....	122	607	146	305.7	1,907
Herd bulls.....	100	106	131	76.1	346
Total cattle.....	.....	2,731	.....	2,400.3	\$11,591
Sheep.....	8	199	134	31.3	106
Horses and colts.....	52	124	99	64.8	248
Total owned.....	.....	3,054	.....	2,496.4	\$11,945
Stock taken in:					
Mature.....	11	19	133	15.9	.....
Young.....	12	68	152	32.5	.....
Total.....	.....	3,141	.....	2,544.8	.....

Acres of pasture per animal unit, 3.1.

Cost for each cattle unit of farmer's own stock, \$4.83.

Bedding

Waste hay and stover from the mangers furnished a considerable quantity of bedding. No charge was made for this, since it was charged to the cattle as forage. Very little bedding was purchased. The bedding cost was apportioned to cows, heifers, and herd bulls on each farm. The data are given in table 6:

TABLE 6. BEDDING USED BY 2058 COWS, 1002 HEIFERS, AND 172 HERD BULLS

Kind of bedding	All herds			Cows		Heifers		Herd bulls	
	Number of farms using	Amount (tons)	Value	Number of farms using	Value	Number of farms using	Value	Number of farms using	Value
Home-grown:									
Oat straw.....	90	269.3	\$1,483	92	\$1,171	65	\$225	51	\$87
Buckwheat straw.....	21	32.7	105	22	101	1	4	.....	0
Wheat straw.....	1	0.5	2	1	2	.....	0	.....	0
Rye straw.....	1	3.0	24	1	18	1	2	1	4
Chaff.....	6	?	27	6	17	2	6	3	4
Swamp and marsh hay.....	6	9.5	50	5	40	3	8	2	2
Sawdust.....	9	?	22	8	22	.....	0	.....	0
Total home-grown....	.....	.....	\$1,713	.....	\$1,371	.....	\$245	.....	\$97
Purchased:									
Sawdust.....	52	?	\$315	51	\$275	12	\$28	8	\$12
Shavings.....	5	?	26	5	18	1	5	1	3
Buckwheat straw.....	1	?	14	1	2	1	10	1	2
Oat straw.....	3	?	12	2	7	2	4	1	1
Total purchased.....	.....	.....	\$367	.....	\$302	.....	\$47	.....	\$18
Total bedding.....	.....	.....	\$2,080	.....	\$1,673	.....	\$292	.....	\$115

Labor

Some farmers hauled their own milk, while many hired it hauled. Some spent considerable time in making and repairing pasture fences or in constructing and repairing buildings, while others spent little. For these reasons it was thought best to include such time under charges for milk hauling, pasture, and use of buildings, rather than under labor.

Excepting this, and also time spent in raising and harvesting crops and time spent hauling manure from the barnyard, all human and horse labor for the dairy enterprise was charged under the heading *Labor*. This includes all labor in milking, taking care of milk and dairy equipment, feeding, cleaning cattle and stables, hauling and mixing feed, hauling bedding, buying and selling cattle, and all other time spent for cattle. Not only was this labor divided as to whether it was spent for cows, for heifers, or for herd bulls, but it was also divided according to whether it was spent during the pasture period or during the winter period. The average wage of male farm labor without board in New York in 1915 was \$35.80 a month.⁶ This is about fifteen cents an hour for a nine-hour day, but probably is too low because use of house, wood, and other things furnished are not included in all cases. Farm operators, however, could ordinarily hire out to operate farms at more than hired men's wages, and their time, therefore, should be counted at a higher rate. The time of women and children usually is not so valuable as the time of men.

The cost of labor per hour depends largely on the size of the business, on the layout of the farm, on the type and intensity of farming, and on wages. Other things being equal, the rates are usually higher on the one-man farms than on the two-man farms. But since no records of the cost of labor on these farms were available, it was necessary to charge labor to dairy cattle at the same rate on each farm, irrespective of the variations mentioned.

Man labor was charged at 15 cents an hour. Since no records of any kind were available to show what woman and child labor cost, it was charged at 10 cents an hour. Horse labor was charged at 15 cents an hour.

The data for labor costs are given in table 7 (page 288).

Milk hauling

In order to make comparisons between farms that hired milk hauled and those where milk was hauled by the farmer, the cost of hauling milk was kept separate from other costs.

When the farmer drew his own milk only, or when he cooperated with neighbors in hauling, the cost was found by multiplying the hours of human and horse time required by the same rates per hour as were used for other labor.

⁶ United States Department of Agriculture. Monthly crop report, March, 1917, page 25.

TABLE 7. LABOR CHARGES, 2058 COWS, 1002 HEIFERS, AND 172 HERD BULLS

Labor for	Pasture period, 159 days				Winter period, 206 days				Total			
	Number of farms using	Hours spent	Per cent	Number of farms using	Hours spent	Per cent	Number of farms using	Hours spent	Per cent	Value	Per cent	Per cent
Cows:												
Human labor:												
Milking:												
Man.....	147	70,159	59	149	86,585	38	149	156,744		\$23,511.60		
Woman.....	36	8,640	7	26	7,879	4	37	16,459		1,645.90		
Child.....	25	5,254	5	20	6,897	3	26	12,151		1,215.10		53
Care of cows, product, and utensils:												
Man.....	135	26,420	22	148	107,157	47	148	133,577		20,036.55		
Woman.....	120	6,185	5	121	8,285	4	121	14,470		1,447.00		
Child.....	15	1,775	2	8	3,095	1	18	4,870		487.00		45
Hauling feed.....	1	35		102	4,014	2	103	4,049		607.35		
Other human labor for cows.....	9	618		26	2,432	1	32	3,050		457.50		2
Total human labor for cows.....		110,986	100		226,284	100		345,370	100	\$49,408.00	100	
Horse labor for cows.....	1	16		119	11,203		119	11,279		\$1,691.85		
Heifers:												
Human labor.....	75	4,696		142	23,038		144	27,734		\$4,160.10		
Horse labor.....	1	10		48	1,249		49	1,259		188.85		
Herd bulls:												
Human labor.....	34	1,145		120	6,852		122	7,997		1,190.55		
Horse labor.....				5	37		5	37		5.53		
Total human labor.....		124,927			256,174			381,101		\$84,767.65		
Total horse labor.....		26			12,549			12,575		1,886.25		

TABLE 8. CHARGES FOR HAULING AND DELIVERING TO THE MILK STATIONS 104,732 HUNDREDWEIGHT OF MILK

Labor used	Total			Time spent hauling independently			Time spent hauling in cooperation		
	Number of farms using	Hours spent	Value	Number of farms using	Hours spent	Value	Number of farms using	Hours spent	Value
Human labor:									
Man.....	88	36,697	\$5,504.55	68	30,816	\$4,622.40	22	5,881	\$882.15
Boy.....	5	1,540	154.00	5	1,540	154.00	.....	.....	.....
Girl.....	2	1,092	109.20	2	1,092	109.20	.....	.....	.....
Woman.....	9	1,008	100.80	8	918	91.80	1	90	9.00
Total human labor.....	.....	40,337	\$5,868.55	69	34,366	\$4,977.40	22	5,971	\$ 891.15
Horse labor.....	.....	58,390	8,758.50	69	46,912	7,036.80	22	11,478	1,721.70
Paid for hauling.....	87	.....	5,057.74	.....	.....	.....	.....	.....	.....
Total.....	149	.....	\$19,684.79	69	.....	\$12,014.20	22	.....	\$2,612.85

All charges for the use of the milk wagon, cans, and other equipment used in hauling milk, were included under dairy equipment, rather than under milk hauling. The charge, therefore, includes no expense for use of equipment. When the farmer hired his milk hauled, the money paid was considered the cost of hauling. Whenever a combination of methods was used, the cost was found by adding the cash cost to the farmer's labor charge for hauling.

At the rates used in this study, human labor made up 29.8 per cent, horse labor 44.5 per cent, and cash paid 25.7 per cent, of the cost of hauling the milk. Milk-hauling charges made up 8.2 per cent of the total charges to the enterprise. Of the total time spent, only 14.8 per cent was in cooperation with neighbors.

The figures for milk-hauling costs are given in table 8.

Use of buildings

Values at the beginning and at the end of the year, of the silos, milk houses, ice houses, and those parts of the barns and other buildings used by dairy cattle, or in storing all feed except dry forage used by them, are given in table 9:

TABLE 9. VALUE OF BUILDINGS, 2058 COWS, 1002 HEIFERS, 172 HERD BULLS, AND 76 BULLS TO BE SOLD

Buildings	May 1, 1914		May 1, 1915	
	Number of farms reporting	Value	Number of farms reporting	Value
Dairy and cattle barns*	149	\$127,612	149	\$128,577
Silos.....	54	8,932	60	9,777
Milk houses.....	122	4,708	124	4,821
Ice houses.....	94	3,494	95	3,507
Total.....	.....	\$144,746	.....	\$146,682

Average value, \$145,714.

Increase in value, \$1,936.

* Includes 9 silos built in barns.

The average of these values was \$145,714, or about \$978 per farm. During the year six new silos were erected, so that at the end of the year about 40 per cent of the farms had silos not built inside the barns. The number of silos does not agree with the number of farms feeding silage, for the reason that on some farms the silos were built in the barns and were included with the value of the barn. Most of the farms have milk houses separate from the barns, and 64 per cent have separate ice houses, altho

108 farmers used ice. Often one building is used as both a milk house and storage for ice.

The charge for the use of buildings was made up of interest at 5 per cent on the average value, the cost of new buildings, cost of repairs, insurance, and decreased value. When buildings were worth more at the end of the year, the increase in value was deducted to determine the charge for their use. This was then apportioned to cows, to heifers, to herd bulls, and to bulls to be sold, according to the average number of cattle units of each class on hand at the beginning and at the end of the year.

The data for use of buildings are given in table 10:

TABLE 10. CHARGES FOR USE OF BUILDINGS, 2058 COWS, 1002 HEIFERS, 172 HERD BULLS, AND 76 BULLS TO BE SOLD

	Number of farms reporting	Amount
New buildings and building repairs:		
Purchased lumber.....	7	\$ 287.40
Shingles and roofing.....	18	565.00
Paint and glass.....	40	427.70
Hardware.....	3	113.60
Materials from farms.....	17	424.50
Sand and gravel.....	6	21.25
Cement.....	9	200.40
Labor:		
Hired.....	18	942.45
Farm.....	26	516.16
Horse.....	7	74.20
Board of labor.....	6	26.50
New buildings, labor and materials.....	10	1,911.50
Total.....	86	\$5,510.66
Interest on \$145,714 at 5 per cent.....		\$7,285.70
Insurance.....		455.00
Total.....		\$13,251.36
Less increase in value*.....		1,936.00
Net charge.....		\$11,315.36

Apportionment of cost

	Number of farms having expense	Amount charged
Cows.....	149	\$8,705.69
Heifers.....	146	2,143.21
Herd bulls.....	126	464.46
Bulls to be sold.....	1	2.00

* Depreciation on buildings, 2.45 per cent of average value.

Use of equipment

The value of the different kinds of equipment used by dairy cattle, on hand at the beginning and at the end of the year, and the number of farms having each kind, are given in table 11:

TABLE 11. VALUE OF EQUIPMENT USED BY 2058 COWS, 1002 HEIFERS, AND 172 HERD BULLS

	May 1, 1914		May 1, 1915	
	Number of farms	Value of equipment	Number of farms	Value of equipment
Milk cans.....	120	\$1,040	122	\$ 997
Coolers.....	10	30	11	34
Testers, bottles, and scales.....	17	44	18	46
Separators.....	15	311	16	323
Churns and workers.....	40	85	40	85
Bottles and containers.....	7	11	7	11
Milk wagons.....	90	1,710	92	1,686
Milking machines.....	.....	.....	1	250
Ice tools.....	91	237	91	236
Feed cutters.....	1	25	1	25
Pumps.....	1	3	1	3
Root cutters.....	4	10	2	6
Grinders and engines.....	10	788	14	794
Milk pails and strainers.....	147	314	148	332
Extra calf pails.....	31	33	33	34
Clipping machines.....	24	115	28	141
Veterinary outfits.....	11	21	13	25
Forks, shovels, and other barn tools...	126	360	122	364
Wheelbarrows and trucks.....	41	103	47	114
Staffs and halters.....	22	23	24	28
Total.....	.....	\$5,263	.....	\$5,534

Average value, \$5,398.

Increase in value, \$271.

More than three-fifths of the value of equipment is in milk cans, pails, strainers, and other dairy utensils, and wagons used in hauling milk. The farmers, with the exception of the patrons of one company, owned the cans they used. Since much of this equipment is in daily use, it requires frequent repairing and must be replaced often. Hence its upkeep represents the largest part of the annual cost of dairy equipment.

The charge for the use of equipment includes interest at 5 per cent on the average value at the beginning and at the end of the year, cost of equipment purchased during the year, repairs on equipment, and decreased value less any increase in value. This cost was apportioned for each farm, to cows, to heifers, and to herd bulls, according to the number of animals and the amount of equipment used by them. The charges are given in table 12:

TABLE 12. CHARGES FOR USE OF EQUIPMENT, 2058 COWS, 1002 HEIFERS, AND 172 HERD BULLS

	Number of farms having expense	Amount
Interest on \$5,398 at 5 per cent*	149	\$ 269.90
Equipment purchased	133	1,079.30
Repairs	76	230.00
Total		\$1,579.20
Less increase in value		271.00
Net charge		\$1,308.20

Apportionment of cost

	Number of farms having expense	Amount charged
Cows	149	\$1,015.10
Heifers	138	221.45
Herd bulls	102	71.65

* Depreciation, 19.2 per cent of average value.

Interest

Separate interest charges at 5 per cent were made on the average value of cattle and on the average investment in feed and supplies kept on hand for cattle. As previously indicated, the other interest charges were included under use of pasture, use of buildings, and use of equipment.

The average value of cows, heifers, and herd bulls was \$163,124. Due to averaging each record separately, the value here used is \$163,109,

TABLE 13. INTEREST ON AVERAGE VALUE OF 2058 COWS, 1002 HEIFERS, AND 172 HERD BULLS

Kind of stock	Average number from inventory	Average value from inventory	Value used in charging interest	Interest at 5 per cent	Number of farms having expense
Cows	2,058	\$133,152	\$133,148	\$6,657.40	149
Heifers under one year	532.5	7,296	23,626	1,181.30	146
Heifers one year or over	469.5	16,338			
Bull calves to be kept	67	1,074	6,335	316.75	126
Herd bulls one to two years	59.7	2,162			
Herd bulls over two years old	45	3,102			
Total		\$163,124	\$163,109	\$8,155.45	

the interest on which amounts to \$8155.45. Since veals and bulls to be sold are kept on hand for only a short time, no interest was charged on their value. The data are given in table 13.

Interest was charged to the dairy enterprise on the investment in forage for the average length of time the forage was stored before it was fed, and on the investment in concentrates from the time they were paid for until they were fed. On each record this cost was distributed to cows, heifers, and herd bulls, according to the numbers of animals kept and the quantities of feed used. The average total capital so invested was \$38,160, or about \$256 per farm. On some farms keeping heifers and herd bulls the interest charge on feed and supplies was so small that it was not separated. The data are given in table 14:

TABLE 14. INTEREST ON AVERAGE VALUE OF FEED AND SUPPLIES KEPT ON HAND FOR 2058 COWS, 1002 HEIFERS, AND 172 HERD BULLS

All herds			Cows		Heifers		Herd bulls	
Average value of feed and supplies on hand	Number of farms having expense	Interest at 5 per cent	Number of farms having expense	Amount charged	Number of farms having expense	Amount charged	Number of farms having expense	Amount charged
\$38,160	149	\$1,908	149	\$1,511.50	120	\$305.50	81	\$91.00

Miscellaneous costs

All remaining expenses were classed as miscellaneous costs, and are given in table 15. Of these, ice, veterinary fees, medicines and disinfectants, fly protectors, whitewash, and expenses for testing milk, were the most important. Farmers having the expense for milk testing estimated the portion of this expense that should be charged to cows, to heifers, to bulls to be sold, and to herd bulls. The same was done with other items not wholly chargeable to cows.

The average amount of ice stored per cow was 1949 pounds.

Returns

Returns from dairy cattle on the farms studied were classified as (1) milk and milk products, (2) appreciation on cattle, (3) manure recovered, (4) miscellaneous returns.

Milk and milk products

Milk sold.—Of the 149 farms, 52 sold to the Empire State Dairy Company at Windsor and 1 to this company at Oquaga, 39 sold to Cloverdale Farms Company at Binghamton, 18 sold to F. W. Jansen at Whitney's Point, 16 to Bordens' at Tunnel, 7 to Sheffield Farms, Slawson-Decker Company, at Conklin, 5 to Bordens' at Whitney's Point, 3 to the Broome County Dairy Company at Binghamton, 7 a part of the year to F. W.

TABLE 15. MISCELLANEOUS COSTS, 2058 COWS, 1002 HEIFERS, 172 HERD BULLS, AND 76 BULLS TO BE SOLD

Item	All herds		Cows		Heifers		Herd bulls		Bulls to be sold	
	Number of farms having expense	Cost	Number of farms having expense	Cost	Number of farms having expense	Cost	Number of farms having expense	Cost	Number of farms having expense	Cost
Ice, 2006 tons.....	108	\$1,711	108	\$1,711	.....	.....	.....	.....	.....	.....
Veterinary fees.....	51	347	50	327	3	\$20	.....	.....	.....	.....
Medicines, disinfectants, and louse killers.....	84	259	82	235	17	23	1	\$1	.....	.....
Fly protectors.....	107	268	107	259	5	5	4	4	.....	.....
Whitewashing.....	105	317	105	307	3	9	1	1	.....	.....
Milk testing, acids, etc.....	17	322	16	248	10	74	.....	.....	.....	.....
Insurance on cattle.....	104	176	104	162	12	13	1	1	.....	.....
Feed grinding and freight.....	34	100	26	81	11	16	3	3	.....	.....
Registration and transfer fees.....	6	31	.....	.....	3	13	2	5	.....	\$13
Express on stock.....	3	3	2	2	.....	.....	1	1	.....	2
Advertising.....	1	2	.....	.....	.....	.....	.....	.....	.....	.....
Sawdust for ice.....	19	53	19	53	.....	.....	.....	.....	.....	.....
Hauling feed.....	3	16	3	14	1	1	1	1	.....	.....
Hauling bedding.....	2	18	2	15	1	2	1	1	.....	.....
Gasoline, oil, and batteries.....	3	33	3	28	2	4	1	1	.....	.....
Fuel for water heater.....	2	13	2	11	1	2	.....	.....	.....	.....
Clipping.....	12	17	12	16	.....	.....	1	1	.....	.....
Lime.....	1	1	1	1	.....	.....	.....	.....	.....	.....
Board of cows.....	1	26	1	26	.....	.....	.....	.....	.....	.....
Total.....	.....	\$3,713	.....	\$3,496	.....	\$182	.....	\$20	.....	\$15
Breeding fees.....	28	\$183	28	\$183	.....	.....	.....	.....	.....	.....

Jansen and a part of the year to Bordens' at Whitney's Point, and 1 a part of the year to Cloverdale Farms Company and a part of the year to the Broome County Dairy Company at Binghamton. Milk sold to Cloverdale Farms and the Broome County Dairy Company was used in Binghamton, while the remainder was for the New York market.

Practically all milk was sold on six-months contracts made with the milk companies on October 1 and April 1. All concerns except two paid a flat price for milk containing a minimum percentage of butterfat. This per cent was 3.7 for one concern, and 3.8 and 4 per cent for the others. A premium was paid when the milk tested above a certain percentage specified in the contract. The monthly prices paid by three companies are given in table 16. Prices paid by the other companies were about the same.

TABLE 16. MONTHLY PRICES PAID FOR MILK BY THREE COMPANIES, PER HUNDREDWEIGHT

	Company no. 1	Company no. 2	Company no. 3
1914:			
May.....	\$1.20	\$1.05	\$1.25
June.....	1.10	1.00	1.20
July.....	1.35	1.15	1.35
August.....	1.55	1.30	1.50
September.....	1.80	1.40	1.60
October.....	1.95	1.70	1.90
November.....	2.05	1.80	2.00
December.....	2.05	1.80	2.00
1915:			
January.....	1.95	1.75	1.95
February.....	1.80	1.65	1.85
March.....	1.75	1.60	1.80
April.....	1.50	*1.55	1.50
Per cent of butterfat re- quired.....	†4.0	3.7 (for April, 3.8)	
Barn score required:			
Equipment.....	25	25	
Methods.....	45	43	
Premiums in addition to above:			
Butterfat.....	10 cents a hundred pounds if 4.5 per cent or better	10 cents a hundred pounds if 3.8 per cent or better	3 cents a hundred pounds if 4.1 to 4.5 per cent inclu- sive
Barn score.....	2 cents a hundred pounds for each 5 points above 70	10 cents a hundred pounds if score 25 on equipment, 43 on methods	None

* For 3.8-per-cent milk with barn score.

† Average for year.

With one exception, each concern had an inspector visit and score the premises at regular intervals. A premium was paid by some of the companies for a higher score. This encouraged the production of clean milk. One company furnished the lime and equipment, and assisted the

TABLE 17. RETURNS FROM MILK SOLD, 2058 COWS

	Number of farms selling	Number of pounds of milk sold	Per cent of total milk sold	Number of pounds of fat in milk	Average per cent of butterfat	Average amount received for 100 pounds of milk sold	Total amount received for milk sold	Per cent of total amount received
1914:								
May.....	149	1,263,511	12.1	49,277	3.9	\$1.28	\$16,176.20	9.4
June.....	149	1,277,921	12.2	49,839	3.9	1.21	15,427.53	9.0
July.....	149	1,031,219	9.8	41,249	4.0	1.36	14,038.80	8.2
August.....	148	804,535	7.7	32,986	4.1	1.55	12,468.13	7.3
September.....	149	729,411	7.0	30,635	4.2	1.69	12,322.50	7.2
October.....	149	757,937	7.2	31,833	4.2	1.96	14,858.83	8.7
November.....	149	678,288	6.5	28,488	4.2	2.06	13,955.19	8.1
December.....	147	710,820	6.8	29,854	4.2	2.06	14,668.57	8.6
1915:								
January.....	142	735,854	7.0	29,434	4.0	2.00	14,693.08	8.6
February.....	140	674,841	6.4	26,319	3.9	1.88	12,700.94	7.4
March.....	140	813,750	7.8	31,736	3.9	1.80	14,673.42	8.5
April.....	146	924,341	8.8	36,049	3.9	1.51	13,941.59	8.1
Retail.....	53	70,798	0.7	2,974	4.2	2.30	1,627.44	0.9
Total or average.....	.....	10,473,226	100.0	420,673	4.0	\$1.64	\$171,552.22	100.0

farmers in whitewashing their barns twice a year, without charge. The figures for the returns from milk sold are given in table 17.

Milk products sold.— Only seven farms sold butter, and one farm sold 200 pounds of cream. The figures are given in tables 18 and 19.

Milk and milk products used.— The value of all milk used on each farm was calculated by multiplying the number of pounds used by the weighted average price received for all milk sold from the farm. Some farmers

TABLE 18. RETURNS FROM MILK PRODUCTS SOLD AND MILK AND ITS PRODUCTS USED ON FARMS, 2058 COWS

	Number of farms	Number of pounds of product	Number of pounds of fat	Price	Total value
Milk products sold:					
Butter.....	7	1,015	863	\$0.31	\$312.76
Cream.....	1	200	40	1.50	30.00
Total milk products sold.....					\$342.76
Milk used:					
Family.....	147	313,048	12,522	\$1.63	\$5,103.33
Hired men.....	14	17,638	706	1.72	304.16
Milk products used:					
Skimmilk:					
Hogs.....	10	30,700		0.20	59.97
Poultry.....	1	2,200		0.15	3.30
Buttermilk:					
Family use.....	21	7,264		0.22	15.93
Hogs.....	10	3,250		0.23	7.50
Poultry.....	1	100		0.20	0.20
Butter, family use.....	36	5,656	4,808	0.29	1,633.97
Cream, family use.....	11	1,000	200	1.81	180.64
Total milk and its products used, except that fed cattle.....			19,139		\$7,309.00
Equivalent in pounds of milk*.....		371,457			
Milk used:					
Heifers.....	134	215,464	8,619	\$1.63	\$3,517.77
Veals and bulls to be sold.....	94	193,535	7,741	1.62	3,126.91
Bull calves to be kept for herd bulls.....	65	26,275	1,051	1.63	429.47
Milk products used:					\$7,074.15
Skimmilk:					
Heifers.....	32	96,068		\$0.18	\$171.17
Veals and bulls to be sold.....	4	3,072		0.20	6.16
Bull calves to be kept for herd bulls.....	8	6,493		0.17	11.08
Buttermilk:					\$188.41
Heifers.....	3	1,300		\$0.19	\$2.45
Total milk and its products fed cattle.....			17,411		\$7,265.01
Equivalent in pounds of milk*.....		540,907			

* Excluding buttermilk.

fed more milk in months when the price was below the average price for the year, and others fed more when the price was above the average. But the quantity used in the house was practically uniform thruout the season. Since the months in which milk was used were not ascertained, it was necessary to use the average yearly price. The prices used in calculating the value of skimmilk and buttermilk were those furnished by the farmers. An average of 2130 pounds of milk per family was used. The figures are given in table 18 and summarized in table 19.

TABLE 19. SUMMARY OF RETURNS FROM MILK PRODUCTS SOLD AND MILK AND ITS PRODUCTS USED ON FARMS, 2058 COWS

	Milk		Skimmilk		Buttermilk		Butter		Cream		Equivalent in whole milk*	
	Pounds	Value	Pounds	Value	Pounds	Value	Pounds	Value	Pounds	Value	Pounds	Value
Total used, except that fed cattle.....	339,686	\$5,407.49	32,900	\$ 63.27	10,614	\$23.63	5,656	\$1,633.97	1,000	\$180.64	370,242	.....
Total fed cattle.....	435,274	7,074.15	105,633	188.41	1,300	2.45	.....	.....	.....	.....	540,997	.....
Total used on farms.....	765,960	\$12,481.64	138,533	\$251.68	11,914	\$26.08	5,656	\$1,633.97	1,000	\$180.64	911,149	.....
Milk products sold.....	.....	.....	.....	.....	.....	.....	1,015	312.76	200	30.00	1,215	.....
Total.....	765,960	\$12,481.64	138,533	\$251.68	11,914	\$26.08	6,671	\$1,946.73	1,200	\$210.64	912,364	\$14,916.77

* Excluding buttermilk.

Appreciation on cattle

On most farms where dairy cattle are raised to replace those that die and those that are sold, the increased value of young cattle exceeds the depreciation and all losses due to death. On the farms studied, this excess, or appreciation, amounted to \$27,988, or 12 per cent of the returns from cattle. Appreciation and depreciation were calculated in the following manner:

When considering the entire herd as a unit, cattle were charged with the first inventory and all purchases of dairy cattle. They were credited with cattle sold or used, hides, and the second inventory.

Cows were charged with the inventory at the beginning, cows purchased, and heifers that became cows. They were credited with cows sold or slaughtered, cow hides, and the inventory at the end.

Heifers were charged with the first inventories, heifers purchased, and value at birth of heifers born during the year. They were credited with heifers sold and slaughtered, value at time of freshening of heifers that freshened during the year for the first time, heifer hides, and the inventories at the end.

Herd bulls were charged with the inventories at the beginning, herd bulls purchased, and value at birth of bull calves born during the year and to be kept for future service. They were credited with herd bulls sold or slaughtered, hides, and the inventories at the end.

Veals and bulls to be sold were charged with the inventories at the beginning, purchases, and value at birth of veal calves and of bulls to be sold that were born during the year. They were credited with veals and bulls sold or slaughtered, hides, and the inventories at the end.

A summary of the appreciation or depreciation on each part of the enterprise is given in table 20.

Calves born during the year were charged to heifers, herd bulls, and veals and bulls to be sold, at their values at birth. They were credited to cows but were not included in the returns from cattle. The data are given in table 21.

Manure recovered

No credit was given for manure produced on pasture, and neither was the pasture charged with it. To have credited and charged manure in these different places would have increased the total costs and total returns for cattle by the same amount, without affecting the gain or loss on the enterprise or the cost of producing milk. The 149 farmers estimated that 20,642 tons of manure was recovered from cattle for use on crop land. This is 7.7 tons per cattle unit, there being 2670.3 cattle units.

The value of manure depends, not only on the composition of the ration, but also on the proportion and kind of litter and especially on the possible returns from its use. Estimates as to its value at the barn averaged about

TABLE 20. APPRECIATION AND DEPRECIATION ON CATTLE, 149 HERDS

	All herds			Cows			Heifers			
	Total number	Total value	Number of farms	Number of cows	Value	Under 1 year			Number of heifers	Value
						Number of farms	Number of heifers	Value		
On hand May 1, 1914.....	3,079.5	\$156,153	149	2,029	\$130,499	124	491	\$6,036	109	\$13,445
Purchased during year.....	284	12,445	47	134	8,620	20	53	474	13	1,358
Born during year.....						140	733	2,232		
Heifers that became cows.....	304	17,217	103	304	17,217					
Total.....		\$185,815			\$156,336			\$9,342		\$14,803
Slaughtered or sold for slaughter.....	1,103.5	\$ 15,088	86	208	\$ 8,009	2	2	\$ 40	5	\$ 239
Sold for breeding and production.....	374	8,800	42	117	6,370	61	188	910	13	372
Died or killed by accident.....	135		38	*55		25	54		5	6
Hides sold.....	134.5	590	38	50	1,430	15	31	32	5	37
Heifers that became cows.....	304	17,217							103	17,217
Deacon hides.....	158	169								
Dead calf hides.....	21	20								
On hand May 1, 1915.....	3,400	171,019	149	2,087	135,805	137	574	7,955	550	19,230
Total.....		\$213,803			\$150,614			\$8,037		\$17,095
Appreciation.....										
Depreciation.....		\$27,088			\$5,722			\$21,887		\$46,032

* Includes 4 killed on railroad and 2 killed by lightning.

Includes \$70 indemnity for 2 cows killed by lightning on one farm.

† The appreciation on cattle exceeds the difference between the appreciation on cattle and the appreciation on one railroad car.

by \$4000, because the value of calves at birth is considered a separate credit for cows but is charged to young cattle in calculating appreciation.

TABLE 20 (concluded)

	Herd bulls						Veals				Bull calves to be sold		
	Bull calves to be kept			1 to 2 years			Over 2 years		Calves fattened		Calves not fattened		
	Num- ber of farms	Num- ber of bulls	Value	Num- ber of farms	Num- ber of bulls	Value	Num- ber of farms	Num- ber of bulls	Num- ber of farms	Num- ber of calves	Value	Num- ber of farms	Num- ber of bull calves
On hand May 1, 1914...	55	62	\$824	51	51.5	\$1,726	40	41	4	11	\$88	5	5
Purchased during year...	24	24	752	19	20.5	779	11	10.5	...	...	...	3	6
Born during year...	50	54	226	...	...	...	...	...	...	...	...	42	75
Heifers that became cows...	...	...	...	...	...	...	...	...	...	...	...	...	...
Total...	...	...	\$1,802	...	...	\$2,445	...	...	...	...	\$88	...	...
Slaughtered or sold for starter...	2	2	\$ 40	26	25.5	\$7,570	29	30	94	368	(\$2,183)	5	5
Sold for breeding and production...	...	...	...	6	7	368	7	7	...	...	\$3,889	...	...
Dead or killed by accident...	2	2	...	1	1	...	...	...	...	...	...	26	42
Hides sold...	3	3	11	4	3.5	28	...	...	9	16	...	1	1
Heifers that became cows...	...	...	...	...	...	...	...	...	18	39	51	1	1
Deacon hides...	...	...	...	...	...	...	...	...	...	...	...	...	...
Dead calf hides...	...	...	...	...	...	...	...	...	...	...	...	...	...
On hand May 1, 1915...	66	72	1,323	61	68	2,577	850	49	8	20	200	20	38
Total...	...	...	\$1,374	...	...	\$3,935	...	...	...	1	4	...	...
Appreciation...	...	...	\$3,339	...	...	(\$10,909)	...	...	...	...	\$967	...	...
Depreciation...	...	...	...	...	...	...	...	...	...	...	...	...	...

|| One farmer purchased half interest in bull.
 § Two farmers owned half interest in bulls.

\$1.25 a ton. This does not include the cost of hauling it to the field. Manure was credited to cattle on each farm at this rate. The credit was then apportioned to cows, to heifers, and to herd bulls, according to the average inventory of cattle units. No attempt was made to calculate

TABLE 21. NUMBER OF CALVES BORN DURING THE YEAR, AND VALUE AT BIRTH

	Number of farms	Number	Per cent	Value	Value of each at birth
Heifers to be raised or to be sold.....	140	733	37	\$2,232	\$3.05
Bulls to be kept.....	50	54	3	226	4.19
Bulls sold or to be sold.....	42	75	4	311	4.15
Calves vealed or to be vealed.....	137	937	48	1,650	1.76
Calves deaconed.....	51	162	8	.....	.....
Deacon hides.....	50	158	.....	169	1.07
Total calves born alive.....	147	1,961	100	\$4,588	\$2.34
Live calves per 100 cows.....	.....	95	.....	.....	.....
Calves born dead.....	35	53	.....	.....	.....
Dead calf hides.....	13	21	.....	20	.....
Total credited to cows.....	.....	.....	.....	\$4,608	.....
Cows that aborted.....	25	41	.....	.....	.....
Farrow cows.....	47	97	.....	.....	.....

the value of manure on the basis of rations fed, for the reason that other factors have an equal, if not greater, influence. Neither was it considered practical to vary the credit to different classes of stock on the basis of the composition of the rations. The value of manure was \$9.66 per cattle unit. This was 11.1 per cent of the total returns from cattle.

The data for manure recovered are given in table 22:

TABLE 22. MANURE RECOVERED FROM 2058 COWS, 1002 HEIFERS, 172 HERD BULLS, AND 76 BULLS TO BE SOLD

Manure recovered	All herds	Cows	Heifers	Herd bulls	Bulls to be sold
Tons.....	20,642	15,917	3,870	851	4
Value at \$1.25 a ton at the barnyard.....	\$25,802	\$19,896.64	\$4,837.65	\$1,063.21	\$4.50

Miscellaneous returns

Two farms received \$157 for hauling neighbors' milk, three farms received \$52 for boarding cattle, and fifteen farms received \$142 for the use of herd bulls. These receipts were included under miscellaneous returns and represented 0.2 per cent of the total returns from the enterprise. The figures for miscellaneous returns are given in table 23:

TABLE 23. MISCELLANEOUS RETURNS

Item	Number of farms having receipt	Total amount received	Credited to	
			Cows	Herd bulls
Hauling neighbors' milk.....	2	\$157	\$157	.....
Breeding fees.....	15	142	.....	\$142
Boarding cows.....	3	52	52	.....
Total.....	.....	\$351	\$209	\$142

Summary of costs and returns

The separate items of costs and returns for the whole enterprise, and for cows, heifers, herd bulls, and veals and bulls to be sold, given in previous tables, are summarized in table 24.

Cost of producing milk and butterfat

In this investigation two different methods of calculating the cost of producing milk or butterfat were used.

By one method, considering the entire herd as a unit, all returns from the herd except milk sold were deducted from the total herd costs, and the difference was considered the cost of milk or fat sold. Any expense for raising young cattle to replace the herd was included in determining the cost of production. The cost calculated in this manner is designated thruout this bulletin as the "herd cost" of milk or butterfat.

By the second method, the returns from cows other than milk sold were deducted from the total cost of keeping cows to determine the cost of milk or fat. Bull service was charged at cost. The raising of heifers to replace the herd was considered separately, and any loss or gain on them was not charged nor credited to milk production. The cost determined in this manner is designated thruout this bulletin as the "cow cost" of producing milk or butterfat.

The herd cost and the cow cost of milk are practically identical. The herd cost is the simpler to calculate, because it is not necessary to separate the feed, labor, and other costs for heifers, bulls, and other cattle. But the quantities of feed and labor used by the herd per hundred pounds of milk are not so useful as the quantities used by cows only.

In purebred herds, the value of young stock for breeding purposes is sometimes so great as to make the herd cost of producing milk very low. The investment in cows, depreciation on cows, amount of feed and labor, bull service, and all other costs, are higher for purebred than for grade herds. But the greater value of the calves at birth usually more than offsets these higher costs, so that the cow cost of producing milk is also usually less in purebred than in grade herds.

TABLE 24. SUMMARY OF COSTS AND RETURNS, 2058 COWS, 1002 HEIFERS, 172 HERD BULLS, 377 VEALS*, AND 76 BULLS TO BE SOLD

Table	All herds			Cows		
	Amount	Value	Percent	Amount	Value	
Costs:						
Grain.....	3,222,483 pounds	\$48,219.00	20.1	2,895,814 pounds	\$42,858.00	
Succulent feeds (except skimmilk).....	5,193.53 tons	24,609.00	10.2	4,777.33 tons	22,512.00	
Dry forage.....	5,277.15 tons	50,790.00	21.1	4,283.05 tons	40,722.00	
Skimmilk, purchased.....	21.8 tons	77.00	0.1	.....	.....	
Skimmilk, farm.....	.....	.....	.....	.....	.....	
Whole milk, farm.....	.....	.....	.....	.....	.....	
Buttermilk, farm.....	.....	.....	.....	.....	.....	
Pasture.....	7,927.5 acres	11,591.00	4.8	.....	.....	9,338.00
Total feed.....	.....	\$135,286.00	56.3	.....	\$115,430.00	
Bedding.....	.....	2,080.00	0.9	.....	1,673.00	
Human labor.....	381,101 hours	54,767.65	22.8	345,370 hours	49,408.00	
Horse labor.....	12,575 hours	1,886.25	0.8	11,279 hours	1,601.85	
Hauling milk.....	.....	19,684.79	8.2	.....	19,684.79	
Use of buildings.....	.....	11,315.36	4.7	.....	8,705.69	
Use of equipment.....	.....	1,308.20	0.5	.....	1,015.10	
Interest on cattle.....	.....	8,155.45	3.4	.....	6,657.40	
Interest on feed and supplies for cattle.....	.....	1,908.00	0.8	.....	1,511.50	
Breeding fees.....	.....	183.00	0.1	.....	183.00	
Cost of keeping herd bulls.....	.....	.....	.....	.....	1,788.30	
Depreciation on cows.....	.....	.....	.....	.....	5,722.00	
Miscellaneous.....	.....	3,713.00	1.5	.....	3,496.00	
Total costs.....	.....	\$240,287.70	100.0	.....	\$216,966.63	
Returns:						
Other than milk sold:						
Milk products sold.....	.....	\$ 342.76	0.1	.....	\$ 342.76	
Milk and its products used on the farm, except that fed cattle.....	.....	7,309.00	3.1	.....	7,309.00	
Milk and its products fed cattle.....	.....	.....	.....	.....	7,265.01	

* Fat calves sold, slaughtered, and on hand at end of year, less number on hand at beginning of year.

TABLE 24 (continued)

	Table	All herds			Cows	
		Amount	Value	Percent	Amount	Value
Returns (concluded):						
Other than milk sold (concluded):						
Appreciation on cattle.....	20	.....	\$27,988.00	12.0	.....	\$ 4,608.00
Calves and calf hides.....	21	.....	.....	.....	.....	19,896.64
Manure.....	22	20,642 tons	25,802.00	11.1	15,917 tons	209.00
Miscellaneous.....	23	.....	351.00	0.2	.....	.....
Total returns, excluding milk sold....	.....	.....	\$61,792.76	.....	.....	\$39,630.41
Milk sold.....	17	10,473,226 pounds	\$171,552.22	73.5	10,473,226 pounds	\$171,552.22
Total returns.....	.....	.....	\$233,344.98	100.0	.....	\$211,182.63
Profit or loss.....	.....	.....	-\$6,942.72	.....	.....	-\$5,784.00
Costs less returns other than milk sold (= cost of milk at market).....	.....	.....	\$178,494.94	.....	.....	\$177,336.22
Cost per hundred pounds sold.....	.....	.....	\$1.704	.....	.....	\$1.693

TABLE 24 (continued)

	Table	Heifers		Herd bulls		Veals and bulls to be sold	
		Amount	Value	Amount	Value	Amount	Value
Costs:							
Grain.....	1	267,116 pounds	\$4,390.00	58,203 pounds	\$ 948.00	1,350 pounds	\$ 23.00
Succulent feeds (except skim-milk).....	2	335.35 tons	1,700.00	80.85 tons	397.00	.....	.....
Dry forage.....	3	806.1 tons	8,140.00	187.1 tons	1,911.00	0.9 ton	11.00
Skim milk, purchased.....	2	18.69 tons	64.00	1.39 tons	6.00	1.72 tons	7.00
Skim milk, farm.....	18	96,068 pounds	171.17	6,493 pounds	11.08	3,072 pounds	6.16
Whole milk, farm.....	18	215,464 pounds	3,517.77	26,275 pounds	429.47	193,535 pounds	3,126.91
Buttermilk, farm.....	18	1,300 pounds	2.45	.....	.....	.....	.....
Pasture.....	5	.....	1,907.00	.....	346.00	.....	.....
Total feed.....	.....	.....	\$19,898.39	.....	\$4,048.55	.....	\$3,174.07
Bedding.....	6	.....	292.00	.....	115.00	.....	.....
Human labor.....	7	27,734 hours	4,160.10	7,997 hours	1,199.55	.....	.....
Horse labor.....	7	1,259 hours	188.85	37 hours	5.55	.....	.....
Hauling milk.....	8	.....	.....	.....	.....	.....	.....
Use of buildings.....	10	.....	2,143.21	.....	464.46	.....	2.00
Use of equipment.....	12	.....	221.45	.....	71.65	.....	.....
Interest on cattle.....	13	.....	1,181.30	.....	316.75	.....	.....
Interest on feed and supplies for cattle.....	14	.....	305.50	.....	91.00	.....	.....
Breeding fees.....	15	.....	.....	.....	.....	.....	.....
Cost of keeping herd bulls.....	131	.....	.....	.....	.....	.....	.....
Depreciation on cows.....	20	.....	.....	.....	.....	.....	.....
Miscellaneous.....	15	.....	182.00	.....	20.00	.....	15.00
Total costs.....	.....	.....	\$28,572.80	.....	\$6,332.51	.....	\$3,191.07
Returns:							
Other than milk sold:							
Milk products sold.....	18	.....	.....	.....	.....	.....	.....
Milk and its products used on the farm, except that fed cattle.....	18	.....	.....	.....	.....	.....	.....

TABLE 24 (concluded)

	Table	Heifers		Herd bulls		Veals and bulls to be sold	
		Amount	Value	Amount	Value	Amount	Value
Returns (concluded):							
Other than milk sold (concl'd):							
Milk and its products fed cattle.....	18						
Appreciation on cattle.....	20		\$21,887.00		\$3,339.00		\$3,876.00
Calves and calf hides.....	21						
Manure.....	22	3,870 tons	4,837.65	851 tons	1,063.21	4 tons	4.50
Miscellaneous.....	23				142.00		
Total returns, excluding milk sold.....							
Milk sold.....	17						
Total returns.....							
Profit or loss.....			\$26,724.65		\$4,544.21		\$3,880.50
			-\$1,848.15		† \$1,788.30		+\$689.43
Costs less returns other than milk sold (= cost of milk at market).....							
Cost per hundred pounds sold..							

† Charged to cows.

The cost includes delivering to the receiving stations. Prices are paid for milk delivered. In order to be comparable the cost of production on different farms should therefore include the cost of delivery.

A comparison of the herd cost and the cow cost of producing milk and butterfat is given in table 25:

TABLE 25. SUMMARY OF COST OF PRODUCING AND DELIVERING TO MARKET 104,732 HUNDREDWEIGHT OF MILK CONTAINING 420,673 POUNDS OF BUTTERFAT

	Herd cost			Cow cost		
	(2058 cows, 1002 heifers, 172 herd bulls, 377 veals, and 76 bulls to be sold)			(2058 cows)		
	Per hundred pounds of milk sold	Per cent	Per pound of butterfat	Per hundred pounds of milk sold	Per cent	Per pound of butterfat
Costs:						
Grain.....	\$0.460	20.1	\$0.1146	\$0.409	20.2	\$0.1019
Succulent feed.....	0.236	10.3	0.0587	0.215	10.6	0.0535
Dry forage.....	0.485	21.1	0.1207	0.389	19.2	0.0968
Pasture.....	0.111	4.8	0.0276	0.089	4.4	0.0222
Total feed.....	\$1.292	56.3	\$0.3216	\$1.102	54.4	\$0.2744
Bedding.....	0.020	0.9	0.0049	0.016	0.8	0.0040
Human labor.....	0.523	22.8	0.1302	0.472	23.3	0.1174
Horse labor.....	0.018	0.8	0.0045	0.016	0.8	0.0040
Hauling milk.....	0.188	8.2	0.0468	0.138	9.3	0.0468
Use of buildings.....	0.108	4.7	0.0269	0.083	4.1	0.0207
Use of equipment.....	0.012	0.5	0.0031	0.010	0.5	0.0024
Interest on cattle.....	0.078	3.4	0.0194	0.064	3.1	0.0158
Interest on feed and supplies.....	0.018	0.8	0.0045	0.014	0.7	0.0036
Breeding fees.....	0.002	0.1	0.0004	0.002	0.1	0.0004
Cost of keeping herd bulls.....				0.017	0.8	0.0043
Depreciation on cows.....				0.055	0.5	0.0136
Miscellaneous.....	0.035	1.5	0.0088	0.033	1.6	0.0083
Total costs.....	\$2.294	100.0	\$0.5711	\$2.072	100.0	\$0.5157
Returns other than milk sold:						
Milk products sold.....	\$0.003	.....	\$0.0008	\$0.003	.....	\$0.0008
Milk and its products used on farm, except that fed cattle.....	0.070	.....	0.0174	0.070	.....	0.0174
Milk and its products fed cattle.....		.....		0.070	.....	0.0173
Appreciation on cattle.....	0.267	.....	0.0665		.....	
Calves and calf hides.....		.....		0.044	.....	0.0109
Manure.....	0.247	.....	0.0613	0.190	.....	0.0473
Miscellaneous.....	0.003	.....	0.0008	0.002	.....	0.0005
Total returns, other than milk sold.....	\$0.590	.....	\$0.1468	\$0.379	.....	\$0.0942
Cost of milk or butterfat at market.....	\$1.704	.....	\$0.4243	\$1.693	.....	\$0.4215

The gross herd charges per hundred pounds of milk sold were \$2.29, but the returns other than milk sold amounted to 59 cents per hundred pounds. The herd cost of milk, therefore, was \$1.70 per hundred pounds sold.

The gross cow charges were \$2.07 per hundred pounds, and the returns other than milk sold were 38 cents. Hence, the cow cost of milk was \$1.69 per hundred pounds sold.

The herd cost and the cow cost were practically the same, the former being 1.1 cents per hundred pounds higher. In other words, the loss on heifers, above the gain on veals and bulls to be sold, increased the cost of milk production only by this amount.

The gross herd charges were 57.1 cents per pound of butterfat sold. The returns other than for milk sold were 14.7 cents, so that the net herd cost per pound of butterfat was 42.4 cents.

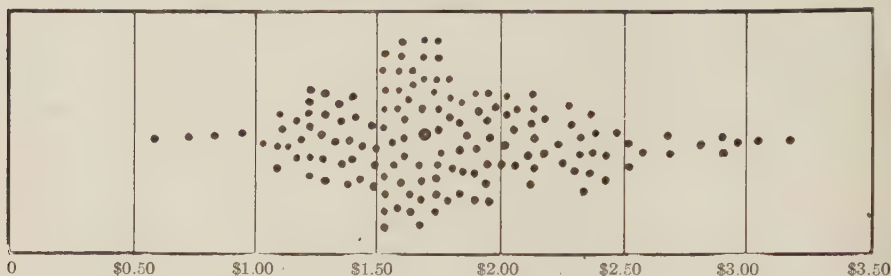


FIG. 53. VARIATION IN HERD COST OF PRODUCING MILK, 149 FARMS

The cow charges were 51.6 cents per pound of butterfat. The returns, except for milk sold, were 9.4 cents, making the net cow cost per pound of butterfat sold 42.2 cents.

Per cent
of all
milk sold

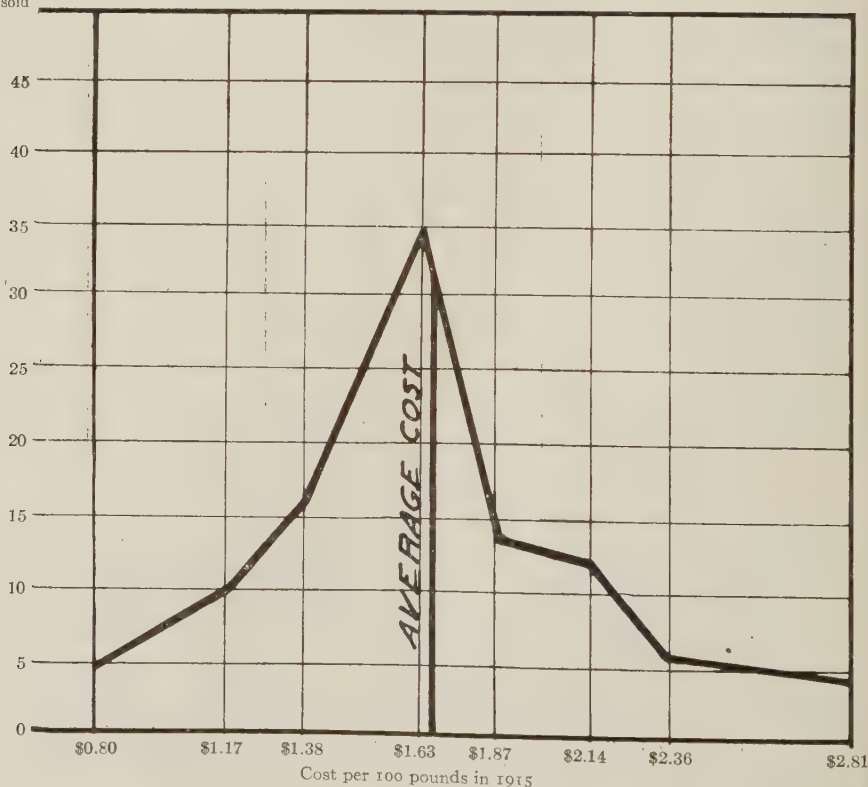


FIG. 54. VARIATION IN HERD COST OF PRODUCING MILK, 149 FARMS

TABLE 26. VARIATIONS IN THE HERD COST OF PRODUCING MILK ON 149 FARMS

Herd cost of milk per hundredweight	Number of farms	Per cent of number of farms	Average cost per hundredweight	Number of cows	Per cent of number of cows	Hundredweight of milk sold	Per cent of all milk sold by each group	Cumulative per cent of milk sold	Hundredweight of milk sold, November to April	Per cent of all milk sold, November to April	Per cent of group milk sold, November to April
Under \$1.00.....	4	2.7	\$0.80	72.5	3.5	3,902	3.7	3.7	1,334	2.9	34.2
\$1.00-\$1.25.....	15	10.1	1.17	195.5	9.5	10,131	9.7	13.4	4,175	9.2	41.2
1.26-1.50.....	20	13.4	1.38	311.5	15.1	17,020	10.3	29.7	7,127	15.7	41.9
1.51-1.75.....	45	30.2	1.63	590.5	33.9	36,735	35.1	64.8	15,586	34.4	42.4
1.76-2.00.....	24	16.1	1.87	290.0	13.1	13,481	12.9	77.7	6,005	13.3	44.5
2.01-2.25.....	17	11.4	2.14	270.0	11.9	12,200	11.6	89.3	5,913	13.0	48.5
2.26-2.50.....	13	8.7	2.36	144.0	7.0	6,428	6.1	95.4	3,142	6.9	48.9
Over \$2.50.....	11	7.4	2.81	122.5	6.0	4,829	4.6	100.0	2,697	4.6	43.4

When the calculations were based on the total amount of milk or butter-fat produced, the cow cost of production was practically the same as when the milk or fat sold was used. The cow cost per hundred pounds of milk produced was \$1.689, and the cost per hundred pounds sold was \$1.693. The cow cost of fat was 42 cents per pound produced, or 42.2 cents per pound sold.

The lowest herd cost of milk production was 56 cents per hundred pounds. To increased value on purebred cows and higher values of the calves at birth this low cost was due. The highest cost was \$3.19 per hundred pounds. Of the farms studied, 48 per cent produced milk at less than the average cost, but 54 per cent of the milk was produced at less than the average cost. The more efficient farms produce a larger proportion of the product. The average cost of all milk produced below the average cost was \$1.39 per hundred pounds, and of all milk at the average cost or above, \$2.06 per hundred pounds.

Variations in the herd cost of producing milk on these farms are shown in table 26 and in figures 53 and 54.

Quantities of feed and labor per unit of product

The amounts of feed and labor used by all herds, per hundred pounds of milk produced, per hundred pounds produced except that fed cattle, and per hundred pounds sold, are given in table 27:

TABLE 27. AMOUNTS OF FEED AND LABOR USED BY 2058 COWS, 1002 HEIFERS, 172 HERD BULLS, AND 76 BULLS TO BE SOLD, PER HUNDRED POUNDS OF MILK

	Per 100 pounds of milk		
	Produced	Produced, except that fed cattle	Sold
	Pounds		
Grain.....	28.3	29.7	30.8
Succulent feed.....	91.6	96.1	99.6
Dry forage.....	92.7	97.3	100.8
	Hours		
Human labor:			
Hauling milk.....	0.35	0.37	0.39
Other labor.....	3.35	3.51	3.64
Horse labor:			
Hauling milk.....	0.51	0.54	0.56
Other labor.....	0.11	0.12	0.12

Capital invested for milk production

The average investment for milk production was \$3381 per farm, \$244.78 per cow, and \$4.42 per hundred pounds of milk or \$1.10 per pound of

butterfat produced. These values would have been higher in 1920, due to a higher price level for all commodities. The data are given in table 28:

TABLE 28. CAPITAL INVESTED FOR THE PRODUCTION OF 11,385,590 POUNDS OF MILK CONTAINING 457,223 POUNDS OF BUTTERFAT, 149 HERDS

	Total capital	Per cent	Per farm	Per cow	Per 100 pounds of milk produced	Per pound of butterfat produced
Cows.....	\$133,148	26.4	\$ 894	\$64.70	\$1.17	\$0.29
Herd bulls.....	6,335	1.3	42	3.08	0.05	0.01
Other cattle.....	23,626	4.7	159	11.48	0.21	0.05
Buildings.....	145,714	28.9	978	70.80	1.28	0.32
Equipment.....	5,398	1.1	36	2.62	0.05	0.01
Pasture land.....	151,376	30.0	1,016	73.56	1.33	0.33
Feed and supplies....	38,160	7.6	256	18.54	0.33	0.09
Total.....	\$503,757	100.0	\$3,381	\$244.78	\$4.42	\$1.10
Interest at 5 per cent.	\$25,188	.....	\$169	\$12.24	\$0.221	\$0.055

Effect of changes in the price of labor, of feed, and of other factors, on the cost of milk production

The cost of producing milk for any particular farm or for any region is not constant. Whenever the price of cows, the price of feed, the value of land, or wages, change, then the cost of milk production also changes. Hence, when interpreting results of milk-production studies, it is important to keep in mind the possible effect of such changes on cost.

In table 29 are shown the approximate changes in cost made by the change of a single item, provided all other costs remain constant. An increase in any item, however, is accompanied by changes in practically all other items. For example, if any cost increases, the cost of cows, and

TABLE 29. EFFECT OF CHANGES IN PRICES OF LABOR, FEED, AND OTHER FACTORS, ON COST OF PRODUCTION WHEN THE ENTIRE HERD IS CONSIDERED

If other conditions remained exactly the same, a change of:	Would change on these farms	
	The cost of producing 100 pounds of milk	The cost of producing 1 pound of butterfat
	Cents	Cents
1 per cent in the interest rate.....	4.4	1.1
\$10 an acre in the value of pasture land.....	3.3	0.8
1 cent an hour of human labor.....	3.8	0.9
\$1 a ton for grain.....	1.4	0.4
\$1 a ton for succulent feed.....	4.6	1.1
\$1 a ton for dry forage.....	4.6	1.2

hence depreciation and interest on them, also increases. If wages increase, the cost of pasture and buildings goes up. Moreover, a change in the cost of feed, cows, or labor causes dairymen to modify their practices. For all these reasons, one can never safely predict what will be the effect of a change in any one item on the cost of production as a whole.

PART II. CONCERNING COWS

Breeds

Practically all of the dairy herds in Broome County are of grade stock, but most of the cattle carry some Holstein blood. Probably animals of this breed are best adapted to the production of market milk under the prevailing conditions of the region, chiefly because of their large size.

About two per cent of the dairy cattle in the county are purebred. In January, 1917, there were 498 purebred Holsteins on 45 farms, 53 purebred Jerseys on 7 farms, 40 purebred Ayrshires on 2 farms, and 20 purebred Guernseys on 6 farms, in Broome County. On 31 of the farms there were less than 6 head of purebred dairy cattle, and on only 8 of the 149 farms were there as many as 20 purebreds.

On the farms included in this study there were only 39 registered cows. Excepting one Ayrshire and one Dutch Belted, these were all Holsteins. Records for two purebred Holstein herds containing 52 cows were obtained, but were not included in the tabulations. The market for purebred dairy cattle in the southern-tier counties is relatively undeveloped. It is no doubt due largely to this fact, and to the more extensive system of dairying, that few purebred animals have been brought into the county.

Owing to the fact that the herds were so largely of Holstein characteristics, it was impossible to group them in any manner that would allow a comparison of one breed with another. There were six herds of purebred Holstein and Holstein grades, twenty-eight high-grade Holstein herds, twenty-eight herds comprised of Holstein grades and animals of mixed breeding, eleven herds of part Holstein grades and part Jersey grades, six herds of part Holstein grades and part Guernsey grades, and seventy herds of various other combinations of breeding. Most of the larger herds are Holstein grades, while more of the smaller herds are of mixed breeding.

Numbers

The inventories, purchases, sales, and deaths of cows are given in detail in table 20 (page 301). The average number of cows was 2058, and the average value was \$65 a head. The number per farm varied from 6 to 37, the average being 13.8.

During the year 47 farms purchased 134 cows at an average price of \$64 a head. On 103 farms there were 304 heifers that freshened for the

first time during the year. The average value at the time of freshening was \$57 a head. About one cow was purchased or raised for each five kept. But as the herds are increasing in size, and as some cows are sold for production, only one cow of each seven or eight is actually replaced each year. The estimates of 131 dairymen as to the time cows remained in the herd after first freshening averaged 7.5 years.

Of the cows disposed of, 208 were slaughtered or sold for slaughter on 86 farms, and 117 were sold for breeding and production on 42 farms. The average price received for the former was \$38, for the latter \$54, a head.



FIG. 55. GOING TO THE BUTCHER

The figures indicate that about two-thirds of the cows disposed of are slaughtered or sold for slaughter, and that the remaining third go into other herds to be milked. But farmers do not know exactly where the cows they sell go. The relatively low price of those sold for production suggests that probably some that went to the block have been included in this group.

During the year 38 farms lost 55 cows by death or accident. Of these cows, 49 died, 4 were killed on the railroad, and 2 were killed by lightning. This is 2.7 per cent of the average number of cows. Receipts from the sales of hides and insurance for cows killed amounted to \$7.82 per cow lost.

The average price of all cows slaughtered and sold was \$44 a head. This is \$21 a head less than the average value of cows. The depreciation

on cows and the loss due to death was \$5722, or 4.3 per cent of the average value of cows. About two-thirds of this loss is represented by the difference between the value of cows and the price received for those sold, and one-third by deaths. Since the beef value of cows is not in proportion to their value for milk, depreciation and losses due to death are higher with higher-priced cows.

Average production

The average production per cow was 5532 pounds of milk, of which 5089 pounds was sold and 443 pounds was used on the farms, and 222.2 pounds of butterfat, of which 204.4 pounds was sold. About 42 per cent of the milk was produced in the six months beginning on October 1, and 58 per cent in the summer months from April to September.

The income from the sale of milk was more evenly distributed thruout the year than was the production. While more milk was sold in summer, the price received was so much less that the returns did not far exceed the returns in the winter months.

The data on average production are given in table 30:

TABLE 30. PRODUCTION PER COW AND ITS DISTRIBUTION, 2058 COWS

	Number of pounds of milk per cow	Per cent of total yearly production	Number of pounds of butterfat per cow	Receipts per cow from milk sold	Per cent of total receipts
Milk sold:					
May.....	614	12.1	24.0	\$7.86	9.4
June.....	621	12.2	24.2	7.50	9.0
July.....	501	9.8	20.0	6.82	8.2
August.....	391	7.7	16.0	6.06	7.3
September.....	355	7.0	14.9	5.99	7.2
October.....	368	7.2	15.5	7.22	8.7
November.....	330	6.5	13.8	6.78	8.1
December.....	345	6.8	14.5	7.13	8.6
January.....	358	7.0	14.3	7.14	8.6
February.....	328	6.4	12.8	6.17	7.4
March.....	395	7.8	15.4	7.13	8.5
April.....	449	8.8	17.5	6.77	8.1
Retail.....	34	0.7	1.5	0.79	0.9
Total.....	5,089	100.0	204.4	\$83.36	100.0
Milk not sold.....	443	.....	17.8	7.25	.....
Total.....	5,532	.....	222.2	\$90.61	.....

Relative to the receipts on the New York market, much more milk was produced during the summer on the farms studied. The production in February, the lowest month, was 53 per cent of the June production, while on the New York market for the same year the amount received in February was 92 per cent of the amount received in June.

Less milk is furnished the city during July, August, or September than during January by the zones nearer the city.⁷ These zones are the districts of most intensive dairying. The supply from the further zones, however, is much greater during the summer months. Prices paid for milk to be

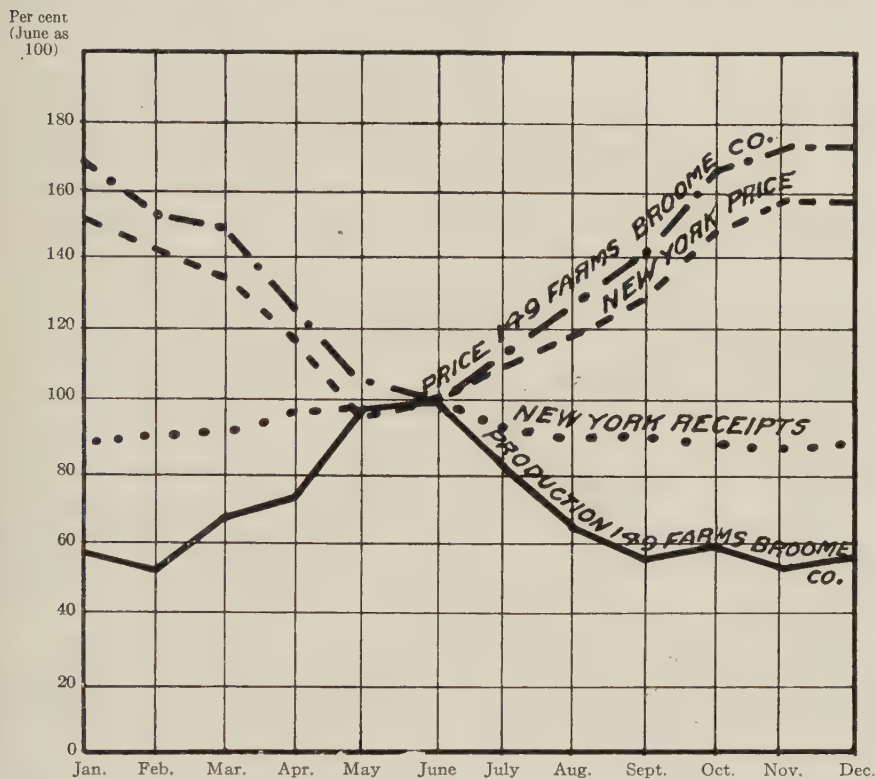


FIG. 56. PRODUCTION AND PRICE FOR 149 BROOME COUNTY FARMS COMPARED WITH RECEIPTS ON, AND WITH AVERAGE PRICES PAID AT SHIPPING STATIONS TO PRODUCERS FOR, THE NEW YORK MARKET

shipped to cities during these months must be in close accord with the prices that can be obtained from milk by making it into butter, cheese, or condensed milk, else milk will be attracted to the shipping stations from the factories and too great a surplus results. Production on these Broome County farms is more typical of the far zones than of the districts nearer the city.

⁷ Preliminary Report of the Joint Legislative Committee on Dairy Products, Livestock, and Poultry. New York Senate Document, no. 35, page 340.

The figures for distribution are given in table 31:

TABLE 31. DISTRIBUTION OF PRODUCTION, AND PRICES RECEIVED FOR MILK, ON 149 BROOME COUNTY FARMS, COMPARED WITH DISTRIBUTION OF RECEIPTS IN THE NEW YORK MARKET AND WITH AVERAGE PRICES PAID AT SHIPPING STATIONS TO PRODUCERS OF MILK FOR NEW YORK CITY, IN THE SAME YEAR

Month	Daily average receipts on New York market, 40-quart cans	Per cent (June figure taken as 100)	Milk sold by 149 farms (hundred-weight)	Per cent (June figure taken as 100)	Average prices paid producers for New York market*	Average prices received by 149 farms
1914:						
May.....	53,450	98	12,635	99	\$1.25	\$1.28
June.....	54,807	100	12,779	100	1.29	1.21
July.....	51,454	94	10,312	81	1.41	1.36
August.....	50,058	91	8,045	63	1.53	1.55
September.....	49,831	91	7,294	57	1.64	1.69
October.....	48,641	89	7,579	59	1.76	1.96
November.....	47,852	87	6,783	53	2.00	2.06
December.....	48,411	88	7,108	56	2.00	2.06
1915:						
January.....	48,332	88	7,359	58	1.94	2.00
February.....	50,529	92	6,748	53	1.85	1.88
March.....	50,996	93	8,138	64	1.76	1.80
April.....	52,419	96	9,243	72	1.53	1.51

* As given in *The Milk Reporter*, Sussex, New Jersey, for the respective months.

Feeds used

The total amounts and values of the various kinds of feed used by cows are given in previous tables. The amounts per cow, per hundred pounds of milk produced, and per pound of butterfat produced, are shown in table 32:

TABLE 32. FEED USED BY 2058 Cows

	From table	Total	Pounds used		
			Per cow	Per 100 pounds of milk produced	Per pound of butterfat produced
Grain.....	1	2,895,814 pounds	1,407	25.4	6.3
Silage.....	2	3,915.9 tons	3,806	68.8	17.1
Other succulent feed...	2	861.43 tons	837	15.1	3.8
Hay.....	3	3,553.45 tons	3,453	62.4	15.5
Other dry forage.....	3	729.60 tons	709	12.8	3.2

An average of about 4 pounds of milk, containing 4 per cent of butterfat, was produced per pound of grain fed. The quantities of feed used on these farms per pound of butterfat produced, check closely with the quantities used in experiment station herds, as shown in table 33. The

TABLE 33. FEED USED AND PRODUCTION PER COW IN EXPERIMENT STATION HERDS

Station	Number of years covered by record	Number of records	Pounds of milk	Butterfat test of milk (per cent)	Pounds of fat	Pounds of concentrates	Pounds of silage	Pounds of other succulent feed	Pounds of hay	Pounds of other dry forage
Connecticut ^a	10	227	5,947	4.67	278	2,277	8,535	176	1,859	38
Massachusetts ^b	15	131	6,036	5.07	306	2,155	1,820	3,118	4,820	278
Michigan ^c	1	29	6,610	3.71	245	2,774	3,649	1,990	3,252	734
Minnesota ^d	1	23	6,408	4.70	301	3,474	3,479	1,827	2,029	.....
Missouri ^e	1	12	5,927	4.18	248	3,027	.....	.....	3,480	.....
Montana ^f	1	15	5,992	4.17	250	1,169	.....	.....	6,468	.....
Nebraska ^g	2	52	8,796	3.87	340	1,981	3,684	.....	2,343	.....
New Jersey ^h	14	415	6,792	4.16	283	2,721	8,008	8,076	1,383	679
Utah ⁱ	5	49	5,601	4.23	237	1,305	.....	.....	4,518	.....
Wisconsin ^j	12	261	7,540	4.28	322	2,014	7,549	1,648	1,356	.....
Total.....	.....	1,214	.....	.....	.....	.....	.....	.....	.....	.....
Simple averages:	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
Per cow.....	.....	.....	6,565	4.30	281	2,290	3,672	1,684	3,151	173
Per 100 pounds of milk.....	.....	.....	.....	.....	.....	34.9	55.9	25.7	48.0	2.6
Per pound of butterfat.....	.....	.....	.....	.....	.....	8.1	13.1	6.0	11.2	0.6

^a Bulletins 29, 73, ^b Bulletin 145, ^c Bulletin 166, ^d Bulletin 35, ^e Bulletin 26, ^f Report 1905, ^g Reports 1897-1906, 1909, 1912-1915, ^h Reports 1897-1906, 1909, 1912-1915, ⁱ Reports 1905-1907, Bulletins 102, 187, 217, ^j Bulletin 101.

station herds used more grain but less dry forage. Since grain contains from two to two and one-half times as much energy as does hay, the extra grain used compensates for the smaller amount of dry forage, especially if one allows for the use of a better grade of hay at the stations. No account could be taken of pasture, as it was reported in days but not in acres used. At the New Jersey and Massachusetts stations, very little pasture was used. These stations depended largely on soiling crops for summer feeding.

Labor required

An average per cow of 90.1 hours of human labor was spent in milking, 19.6 hours in hauling the milk, and 77.7 hours in other work. This is a total of 187.4 hours per cow, 3.38 hours per hundred pounds of milk produced, and 0.85 hour per pound of butterfat produced.

Most of the horse labor was in hauling the milk. This amounted to 28.4 hours out of a total of 33.9 hours per cow.

The data on labor required are given in table 34:

TABLE 34. LABOR REQUIRED FOR 2058 COWS

	Hours per cow*	Hours per 100 pounds of milk produced	Hours per pound of butterfat produced
Human labor:			
Milking:			
Man.....	76.2	1.38	0.34
Woman.....	8.0	0.14	0.04
Child.....	5.9	0.11	0.03
Total.....	90.1	1.63	0.41
Care of cows, product, and utensils:			
Man.....	64.9	1.17	0.30
Woman.....	7.0	0.13	0.03
Child.....	2.4	0.04	0.01
Hauling feed.....	2.0	0.04	0.01
Other human labor.....	1.4	0.02	0.00
Total.....	167.8	3.03	0.76
Hauling milk.....	19.6	0.35	0.09
Total human labor.....	187.4	3.38	0.85
Horse labor:			
Hauling milk.....	28.4	0.51	0.13
Other horse labor.....	5.5	0.10	0.02
Total horse labor.....	33.9	0.61	0.15

* Totals are given in table 7 (page 288).

Costs and returns

The total costs per cow were \$105.43. Of this, 53.2 per cent was for feed including pasture, 22.8 per cent was for human labor except milk

hauling, and 24 per cent was for the remaining items. The total returns per cow were \$102.62, of which 81.2 per cent was for milk sold, 9.4 per cent was for manure, and 9.4 per cent was for other items. The average loss on cows was \$2.81 per cow. (Table 35.) Of the 149 herds, there were 61, or 41 per cent, that showed a profit on cows.

A common question that arises whenever results of cost studies are stated, is, if the actual loss is equal to the apparent loss, how do such producers remain in business? The answer is that they do one or more of the following things: first, accept lower wages than the rate at which their time is charged; secondly, accept less than farm value for roughage used; thirdly, accept a lower rate of interest on their investment than the rate charged.

If these farmers received interest on their investment, the farm value of farm-grown roughage, and all other costs, they then received 11.3 cents an hour for human labor.

TABLE 35. AVERAGE COSTS AND RETURNS, 2058 COWS*

Item	Per cow	Per cent of total
Costs:		
Grain.....	\$20.83	19.7
Succulent feed.....	10.94	10.4
Dry forage.....	19.79	18.8
Pasture.....	4.54	4.3
Total feed.....	\$56.10	53.2
Bedding.....	0.81	0.8
Human labor.....	24.01	22.8
Horse labor.....	0.82	0.8
Hauling milk.....	9.57	9.1
Use of buildings.....	4.23	4.0
Use of equipment.....	0.49	0.4
Interest on cows.....	3.23	3.1
Interest on feed and supplies.....	0.73	0.7
Depreciation on cows.....	2.78	2.6
Bull service.....	0.96	0.9
Miscellaneous.....	1.70	1.6
Total costs.....	\$105.43	100.0
Returns:		
Milk sold.....	\$83.36	81.2
Milk products sold.....	0.17	0.2
Milk and its products used.....	7.08	6.9
Calves and calf hides.....	2.24	2.2
Manure.....	9.67	9.4
Miscellaneous.....	0.10	0.1
Total returns.....	\$102.62	100.0
Loss.....	\$2.81	.....

* Totals are given in table 24 (pages 305 to 303).

If they received 15 cents an hour for all man time and 10 cents an hour for all time of women and children, and interest on their investment, they then received 90 per cent of the value of hay and other roughage used.

If it be assumed that the cost of feed and human labor represents the same proportion of the net cost of producing milk when feed and labor costs are high as when they are low, and that the quantities found in this study are used in the production of milk, then the yearly cost for 1920 price conditions may be computed as shown in table 36. The cost with the prices used would be \$3.47 per hundred pounds. The index number of the prices of all commodities in the United States for the year 1920 was 243, as compared with 99 for the twelve months covered by this investigation.⁸ The average price paid in 1920 to producers of milk for the New York market was \$3.56 per hundred pounds.⁹ Considering that the general price level stood at 245 as compared with that of 1914-15, this price of \$3.56 in 1920 was about equal to a price of \$1.45 in the years covered by this study. A cost of \$3.47 would be approximately no greater when compared with the general price level than a cost of \$1.42 in 1914-15. In the spring months of March, April, and May, 1920, the price of milk was low relative to feed and labor costs, but considering the year as a whole, it would appear that prices paid to shippers of fluid milk for the New York market were fairly well adjusted to cost of production.

The figures for costs and returns are given in table 35, and the probable cost in 1920 of keeping a cow and producing milk is shown in table 36.

TABLE 36. PROBABLE COST IN 1920 OF PRODUCING MILK

	Per cow			Per 100 pounds of milk	
	Amount used by 2058 cows in 1914-15	Estimated price in 1920	Cost at estimated 1920 prices	Amount used by 2058 cows in 1914-15	Cost at estimated 1920 prices
Grain.....	1,407 pounds	\$60.00	\$42.21	25.4 pounds	\$0.762
Silage.....	3,806 pounds	7.00	13.32	68.8 pounds	0.241
Other succulent feed.....	837 pounds	5.00	2.09	15.1 pounds	0.038
Hay.....	3,453 pounds	20.00	34.53	62.4 pounds	0.624
Other dry forage.....	709 pounds	10.00	3.54	12.8 pounds	0.064
Human labor.....	187.4 hours	0.35	65.59	3.38 hours	1.183
Total feed and human labor.....			\$161.28		\$2.912
Per cent of net cost, 83.9					
Total cost assuming that feed and labor represent the same per cent of the net cost as in 1914-15.....			\$192.23		\$3.471

Size of herd

Of the herds on the farms studied, 36 per cent had from six to ten cows, 26 per cent had more than ten but not more than fourteen cows, 18

⁸ United States Bureau of Labor Statistics. Monthly Review, vol. 12, no. 5, May, 1921.

⁹ The Milk Reporter, Sussex, New Jersey, January, 1921, page 16.

per cent had more than fourteen but not more than eighteen cows, and 20 per cent had more than eighteen cows.

Size of farm

The size of the dairy is governed largely by the size of the farm. Farms keeping from six to ten cows averaged 111 acres, those with more than ten but not more than fourteen cows averaged 145 acres, those with more than fourteen but not more than eighteen cows averaged 177 acres, and those with more than eighteen cows averaged 238 acres.

The average distance to the milk station is less from farms with large herds than from farms with small herds. This is explained by the fact that a greater proportion of the large herds are in the valleys. The combined effect of a large load and a shorter haul considerably reduced marketing charges for the larger herds.

Feed used

Larger herds used more grain and more succulent feed per cow, but less dry forage, than did smaller herds. Production was better, and more of the milk was made, in winter. In other words, a more intensive system was followed. This is to be expected since many of these farms are nearer

TABLE 37. RELATION OF SIZE OF HERD TO VARIOUS FACTORS

	Number of cows per farm			
	6 to 10	10+ to 14	14+ to 18	Over 18
Number of farms.....	54	39	27	29
Acres per farm.....	111	145	177	238
Miles to market.....	3.7	3.8	2.5	3.1
Number of farms on hills.....	33	31	19	16
Number of farms in valleys.....	21	8	8	13
Per cent of farms on hills.....	61	79	70	55
Number of cows.....	461	485	436	676
Cows per farm.....	8.6	12.4	16.1	23.3
Number of cattle units.....	612.9	623.0	569.1	865.3
Acres per cattle unit.....	9.7	9.1	8.4	8.0
Cattle units per farm.....	11.4	16.0	21.1	29.8
Number using purebred bulls.....	9	8	7	15
Per cent using purebred bulls.....	17	20	25	52
Per cent of milk produced in six months, October to March.....	40	40	40	45
Pounds of milk per cow.....	5,461	5,323	5,344	5,853
Test of milk.....	4.1	4.0	4.0	4.0
Pounds of butterfat per cow.....	223	213	216	233
Pounds of grain per cow.....	1,313	1,343	1,448	1,484
Pounds of silage per cow.....	2,549	3,822	1,712	6,001
Pounds of other succulent feed per cow.....	811	837	633	988
Pounds of dry forage per cow.....	4,534	4,225	4,777	3,468
Number of farms feeding silage.....	18	22	9	20
Per cent feeding silage.....	33	56	33	69

TABLE 38. RELATION OF SIZE OF HERD TO LABOR USED PER COW AND PER UNIT OF PRODUCT

	Number of cows per farm											
	6 to 10			10+ to 14			14+ to 18			Over 18		
	Total hours	Hours per cow	Hours per 100 pounds of milk produced	Total hours	Hours per cow	Hours per 100 pounds of milk produced	Total hours	Hours per cow	Hours per 100 pounds of milk produced	Total hours	Hours per cow	Hours per 100 pounds of milk produced
Milking.....	46,768	101.5	1.86	45,981	94.8	1.78	36,326	83.3	1.56	56,279	83.3	1.42
Other chores.....	42,970	93.2	1.70	38,702	79.9	1.50	32,361	74.2	1.39	41,874	61.9	1.06
Hauling feed.....	925	2.0	0.04	1,230	2.6	0.05	602	1.4	0.02	1,202	1.9	0.03
Total.....	90,663	196.7	3.60	85,973	177.3	3.33	69,289	158.9	2.97	99,445	147.1	2.51
Hauling milk.....	9,371	20.3	0.37	10,377	21.4	0.40	11,125	25.5	0.48	9,464	14.0	0.24
Total.....	100,034	217.0	3.97	96,350	198.7	3.73	80,414	184.4	3.45	108,909	161.1	2.75

the market and on land that is better adapted to raising good winter feed. Some of the better production in the large herds may be due to the use of silage and to better feeding generally.

Data showing the relation of the size of herd to various other factors are given in table 37.

Labor required

The most important influence of size of herd is on labor per cow and per unit of product. The higher farm wages are, the more important this influence becomes.

In herds of from six to ten cows, averaging 8.6 cows, the labor averaged 217 hours per cow and 3.97 hours per hundred pounds of milk. Less labor was required in each of the groups of larger herds. In herds with more than eighteen cows, averaging 23.3 cows, the figures were 161 hours per cow and 2.75 hours per hundred pounds of milk. The data are given in table 38.

At 15 cents an hour the labor charges per hundred pounds of milk would be 19 cents more for 9-cow herds than for 23-cow herds. At 30 cents an hour they would be 37 cents more, and at 40 cents per hour they would be 49 cents more, per hundred pounds. The figures are given in table 39:

TABLE 39. RELATION OF SIZE OF HERD TO LABOR CHARGE PER UNIT OF PRODUCT

Number of cows per farm	Hours per cow*	Hours per 100 pounds of milk produced*	Labor charges at various rates per hour			
			15 cents	20 cents	30 cents	40 cents
8.6.....	217	3.97	\$0.60	\$0.79	\$1.19	\$1.59
12.4.....	199	3.73	0.56	0.75	1.12	1.49
16.1.....	184	3.45	0.52	0.69	1.04	1.38
23.3.....	161	2.75	0.41	0.55	0.82	1.10
Difference between 9- and 23-cow herds.....			\$0.19	\$0.24	\$0.37	\$0.49

* Including time for hauling milk.

Use of buildings

Much time is often wasted in doing chores in unhandy barns. The inconvenient location of milk house, ice house, or silo increases labor. Barns with cows facing outward so that a wagon, a sled, or a spreader may be driven thru for the manure, save labor, especially if the manure is hauled daily. Such an arrangement is also more convenient when a milking machine is used. There is very little work at the mangers during the pasture period.

The investment in buildings per cow, and the charge for their use, was highest in the small herds. Many small herds were housed in additions attached to the main barn, which reduced the cost of shelter. The larger

TABLE 40. RELATION OF SIZE OF HERD TO COSTS AND RETURNS

	Number of cows per farm					
	6 to 10		10+ to 14		14+ to 18	
	Value		Value		Value	
	Total	Per cow	Total	Per cow	Total	Per cow
Costs:						
Grain, summer.....	\$ 634.00	\$ 1.37	\$ 989.00	\$ 2.04	\$ 838.00	\$ 1.92
Grain, winter.....	8,637.00	18.74	8,675.00	17.89	8,546.00	19.60
Succulent feed.....	3,594.00	7.80	5,458.00	11.25	2,390.00	5.48
Dry forage.....	9,476.00	20.55	9,676.00	19.95	9,842.00	22.57
Total feed.....	\$22,341.00	\$48.46	\$24,798.00	\$51.13	\$21,616.00	\$49.57
Pasture.....	2,310.00	5.01	2,208.00	4.55	1,994.00	4.57
Bedding.....	384.00	0.83	514.00	1.06	309.00	0.71
Human labor.....	12,963.35	28.12	12,060.15	24.87	9,946.95	22.81
Horse labor.....	329.70	0.72	451.35	0.93	304.20	0.70
Hauling milk.....	4,823.80	10.46	5,031.26	10.37	5,113.33	11.73
Use of buildings.....	2,183.88	4.74	2,114.08	4.36	1,686.89	3.87
Use of equipment.....	290.10	0.63	242.85	0.50	188.50	0.43
Interest on cows.....	1,485.60	3.22	1,526.75	3.15	1,354.70	3.11
Interest on feed and supplies.....	333.00	0.72	342.00	0.71	307.50	0.71
Depreciation on cows.....	1,198.00	2.60	1,403.00	2.89	1,280.00	2.94
Bull service.....	404.10	0.88	462.61	0.95	369.42	0.85
Miscellaneous.....	805.00	1.75	862.00	1.78	732.00	1.68
Total costs.....	\$49,851.53	\$108.14	\$52,016.05	\$107.25	\$45,202.49	\$103.68
Returns:						
Milk sold.....	\$36,861.53	\$79.96	\$38,207.68	\$78.78	\$34,776.34	\$79.76
Milk products sold.....	127.69	0.28	115.07	0.24	100.00	0.23
Milk and milk products used.....	4,285.82	9.30	3,537.10	7.29	2,794.14	6.41
Calves and calf hides.....	952.00	2.07	936.00	1.93	814.00	1.87
Manure.....	3,984.77	8.64	4,646.12	9.58	4,488.75	10.30
Miscellaneous.....			165.00	0.34	24.00	0.05
Total returns.....	\$46,211.81	\$100.25	\$47,606.97	\$98.16	\$42,997.23	\$98.62
Loss.....	3,639.72	7.89	4,409.08	9.09	2,205.26	5.06
					\$74,366.62	\$110.01

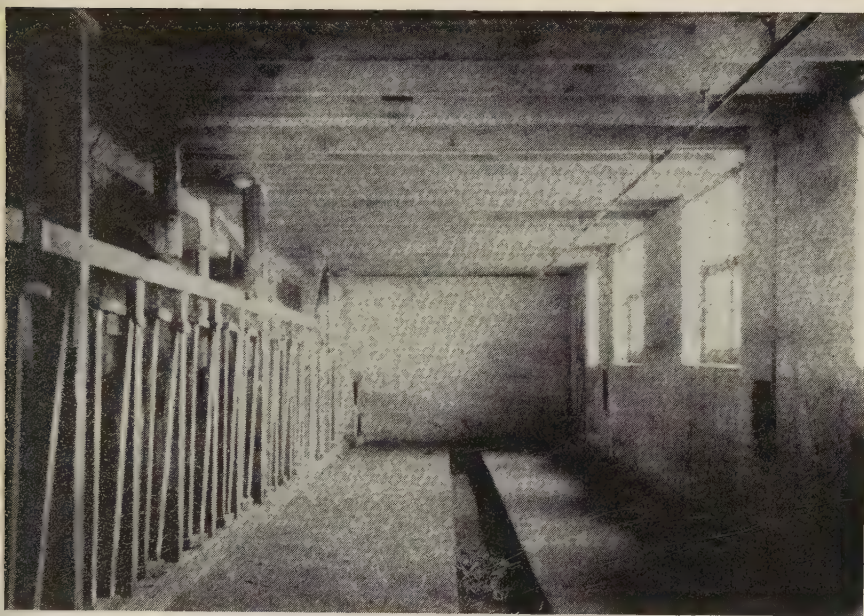


FIG. 57. A WELL-LIGHTED, WELL-VENTILATED, CLEAN, AND COMFORTABLE STABLE

herds were kept in more expensive basements. This increased the cost of shelter. For these reasons the difference in the charge per cow for the use of buildings is relatively little between small and large herds.

Costs and returns

The cost of keeping a cow was less in the larger herds. Partly because of this, but also because the returns were better, there was a greater profit per cow in the larger herds. In small herds the loss was \$8 per cow. In the medium-sized herds the average loss was \$9 per cow. But in the larger herds with an average of 23.3 cows there was a gain of about \$7 per cow. The figures are given in table 40.

TABLE 41. RELATION OF SIZE OF HERD TO COST OF PRODUCTION AND TO AVERAGE PRICE FOR PRODUCT

	Number of cows per farm							
	6 to 10		10+ to 14		14+ to 18		Over 18	
	Herd cost	Cow cost	Herd cost	Cow cost	Herd cost	Cow cost	Herd cost	Cow cost
Cost per hundred pounds of milk sold.....	\$1.82	\$1.80	\$1.81	\$1.81	\$1.74	\$1.72	\$1.54	\$1.54
Per cent of cost (first group taken as 100).....	100	100	99	101	96	96	85	86
Cost per pound of butterfat in milk sold.....	\$0.448	\$0.441	\$0.454	\$0.454	\$0.429	\$0.424	\$0.388	\$0.387
Amount received per hundred pounds of milk sold.	\$1.64		\$1.62		\$1.61		\$1.66	

In the large herds averaging 23.3 cows, the cow cost of milk was \$1.50 per hundredweight, while in the smaller herds averaging 8.6 cows the cow cost was \$1.80 per hundredweight, or about one-fifth more (table 41).

Productive life of cows

Cows were held at a higher value in the larger herds, and also more was paid for those purchased, than in the small herds. But the small herds received more for cows sold, chiefly because a larger proportion of those disposed of went into other herds to be milked rather than to the block. Apparently the productive life of cows was about a year less in large herds than in small herds. There is probably a tendency for the owners of large herds to purchase some of the better cows from small herds.

The data on this point are given in table 42:

TABLE 42. RELATION OF SIZE OF HERD TO PROPORTION OF COWS REPLACED

	Number of cows per farm							
	6 to 10		10+ to 14		14+ to 18		Over 18	
	Number		Number		Number		Number	
	Total	Per 100 cows	Total	Per 100 cows	Total	Per 100 cows	Total	Per 100 cows
Cows purchased.....	47	10.2	29	6.0	22	5.0	36	5.3
Heifers that became cows.....	74	16.1	73	15.0	50	11.5	107	15.8
Total.....	121	26.3	102	21.0	72	16.5	143	21.1
Increase in inventory.....	22	.....	16	.....	4	.....	10	.....
Difference.....	99	21.5	86	17.7	68	15.6	127	18.8
Cows slaughtered or sold for slaughter	56	12.1	26	5.3	33	7.6	93	13.8
Cows sold for production.....	34	7.4	44	9.1	22	5.0	17	2.5
Number of cows that died.....	9	2.0	16	3.3	13	3.0	17	2.5
Average years cow remains in herd as estimated by farmers.....	7.7		7.5		7.2		7.1	

Conclusions on size of herd

Most of the farms studied are primarily dairy farms, with little else than milk to sell. Some of them are small, and a small herd usually means a relatively small income. Data from which the labor income of these farms could be figured were not obtained. However, studies in other counties of the State with similar dairy conditions have shown a striking correlation between labor income and size of herd, and there is no reason to believe that the same would not be true for these farms. On a small farm, keeping less than a two-man dairy, it is difficult to produce milk most economically.

Hence, if enlarging the dairy offers the best opportunity to increase profits, in many cases it will be necessary first to enlarge the farm. By mowing the weeds, cutting the brush, liming, and reseeding, some of the pastures may be improved to carry more stock. On some farms a few more cows may be kept by using a silo. In these ways the herds may

be increased slightly. But any effective increase in the size of herd in most cases means the farming of more land. Often this may be done by renting or by purchasing. Where less than twelve cows are kept because the farm is too small to support a larger herd, more land is essential. But this does not necessarily imply that there must be enough to keep very large herds. It is doubtful whether such herds would produce milk much

Pounds of market
milk sold per
cow per month

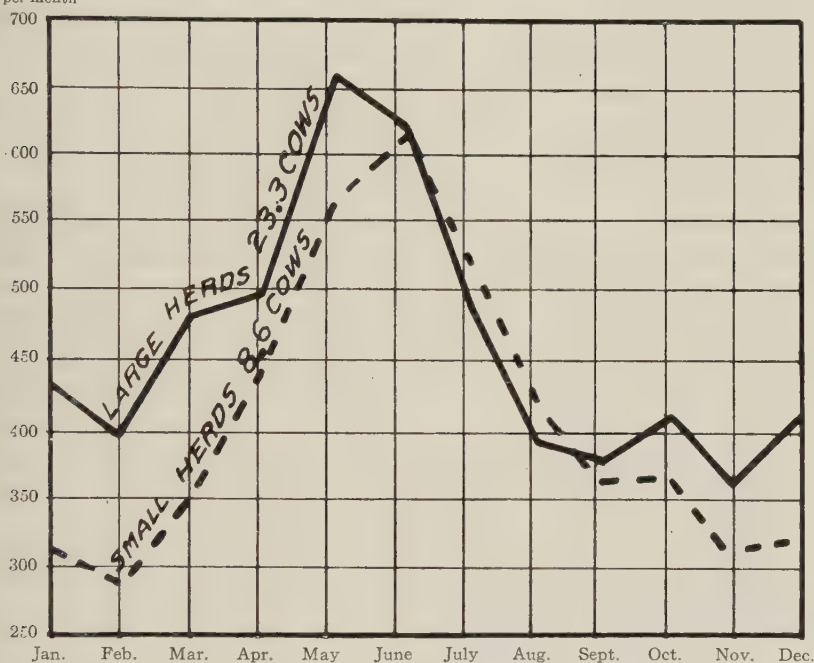


FIG. 58. RELATION OF SIZE OF HERD TO PRODUCTION

With large herds a more intensive system is followed and better production is obtained than with small herds

more economically than herds of from 25 to 50 cows. On the average a 50-cow herd probably requires a farm three times as large as the average farm in the State.

Some farms that are already heavily stocked may find it more profitable not to keep more cows after more acres have been added.

Season of milk production

Summer and winter seasons

Milk-production studies should be based on a year's production rather than on summer or winter periods only, for at least two reasons: first, because the normal lactation of cows is about a year; and secondly, because cows are kept at a heavy loss during a part of the year when dry. So

far as nutriment is concerned, production at the beginning of a lactation period can be obtained more economically than at the end. Hence one season or the other is at a disadvantage, according to the time of freshening or the stage of lactation of most of the cows. In the following comparison the winter period is at a disadvantage because at that time many of the cows were not in milk or were giving only small quantities. Comparison by seasons for herds giving milk distributed more evenly thruout the year are presented later.

Length of the seasons.—On the average, the pasture season began on May 14 and ended on October 19, lasting 159 days. Therefore the winter period comprised 206 days.

How the costs were apportioned.—The quantities and costs of all feed, bedding, and labor for cows, were obtained separately for the pasture and winter periods. The cost of ice and of fly protectors was charged to the pasture period, and interest on feed and supplies was charged to the winter period. Milk-hauling charges were divided according to the relative amount of milk produced in the two periods.

All the remaining costs were apportioned according to the length of the season. These costs included use of buildings, use of equipment, interest on cows, depreciation, bull service, and miscellaneous charges other than those previously mentioned.

How the returns were apportioned.—All the manure recovered during the year was credited to the winter period. The quantities and receipts for milk sold during each period were credited to that period. It was necessary to apportion milk produced during May and October to the pasture season and the winter period according to the days in each of these periods. Retail milk, and all other returns except cream, butter, and buttermilk used on the farm, were divided between the periods according to their length. It was not known how much butter was made during the winter but one-fifth of the butter made on the farm and one-fifth of the cream and buttermilk sold was credited to the pasture period.

Feed used.—Gluten, wheat feed, and wheat bran were the feeds most commonly used in summer. Two farmers used wet brewers' grains. Other feeds were used in smaller quantities.

About two-thirds of the succulent feed used during the pasture period was corn fed green. Very little hay was used at that time.

The figures for concentrates, succulent feed, and dry forage fed during the two periods, are given in tables 43, 44, and 45, respectively.

But most of the milk made in summer is produced on cheap pasture, which takes the place of all of the dry forage and most of the grain. Usually some grain and a small amount of green corn or other succulent feed are used to supplement the pasture late in summer. This averaged about 5 pounds of grain and 23 pounds of succulent feed to 100 pounds of

TABLE 43. CONCENTRATES FED IN PASTURE AND WINTER PERIODS, 2058 COWS

Kind of feed	Pasture period			Winter period		
	Number of herds using	Number of pounds used	Value	Number of herds using	Number of pounds used	Value
Home-grown:						
Oats.....				27	69,507	\$1,043
Buckwheat.....				16	25,220	423
Corn.....				6	13,640	185
Rye.....				1	2,240	50
Barley.....				1	1,250	22
Wheat.....						
Total home-grown..					111,857	\$1,723
Purchased:						
Gluten (feed).....	54	107,099	\$1,623	134	964,906	\$14,651
Cornmeal.....	6	4,360	70	48	121,080	1,954
Hominy.....	1	8,300	124	5	12,195	187
Corn and oats.....				1	90	1
Corn bran.....	1	2,850	11			
Corn middlings.....	1	1,880	17			
Wheat feed.....	31	49,640	768	69	314,296	4,844
Wheat bran.....	20	20,580	293	63	214,655	3,066
Wheat middlings.....				7	7,650	117
Buckwheat middlings.....	1	3,100	50	5	21,900	338
Ground oats.....				1	3,400	54
Cottonseed meal.....	10	7,830	127	67	172,311	2,821
Oilmeal.....				22	7,660	174
Distillers' and brewers' dried grains:						
Continental gluten..				4	21,560	361
Dewey's.....	3	3,600	59	8	32,050	528
Kinds not found....	3	1,700	28	6	9,780	161
Dry equivalent of brewers' grains, wet.....	2	26,808	205	2	33,398	255
Brewers' grains, dried.....	5	4,020	55	25	84,635	1,187
Malt sprouts.....				2	5,000	64
Molasses and molasses feeds:						
Molasses.....				8	9,900	117
Cloverleaf Feed....	4	3,980	53	17	68,710	897
Hammond's Dairy..	2	1,930	26	2	8,730	116
Ideal.....				1	10,000	125
International Special.....				1	10,000	110
Purina.....				1	7,850	130
Sucrene.....				2	5,600	86
Xtra Vim.....				2	2,500	41
Empress.....				1	2,000	23
International Dairy Feed.....				1	28,000	349
Sugar Feed.....	1	400	6	1	2,200	33
Kinds not found....	8	5,515	69	22	97,544	1,268
Other mixed feeds:						
Eggee.....	1	1,000	13	4	24,740	309
Schumacher.....	7	5,590	88	16	38,285	597
Uniongrains (Ubiko)	1	5,000	82	3	43,900	716

TABLE 43 (concluded)

Kind of feed	Pasture period			Winter period		
	Number of herds using	Number of pounds used	Value	Number of herds using	Number of pounds used	Value
Other mixed feeds (concluded):						
Unicorn.....	4	12,700	\$ 216	7	27,220	\$ 460
Grandins' Mixed Feed.....	2	1,150	19	3	3,150	50
Kinds not found...	1	1,200	20	1	1,600	27
Miscellaneous:						
Dried beet pulp.....				7	16,300	221
Alfalfa meal.....				1	100	2
Condimental feed.....				32	*1,350	324
Salt.....	3	1,200	3	141	66,280	346
Total purchased..	.....	281,432	\$4,025	.....	2,502,525	\$37,110
Total concentrates.....	.....	281,432	\$4,025	.....	2,614,382	\$38,833

*Quantities reported for six farms only.

TABLE 44. SUCCULENT FEED FED IN PASTURE AND WINTER PERIODS, 2058 COWS

Kind of feed	Pasture period			Winter period		
	Number of herds using	Number of tons used	Value	Number of herds using	Number of tons used	Value
Home-grown:						
Corn silage.....	10	77	\$ 386	69	3,818.9	\$19,098
Millet silage.....				1	20	60
Corn (green).....	48	404.75	1,065	3	7.2	35
Sweet corn.....	2	7	28			
Turnips.....				19	106.35	456
Potatoes.....				36	70.03	505
Mangels.....	1	6.8	34	3	39.6	108
Carrots.....				3	7.6	82
Apples.....	1	4.8	20			
Beets.....				2	0.5	5
Cabbage fodder.....	4	23	65	3	34	43
Cabbage.....				6	30.75	93
Green rowen.....	2	36	65			
Millet.....	8	27.7	117			
Oats and peas.....	6	27.5	89			
Buckwheat.....	1	10	100	1	4	8
Oats, corn, and millet.....				1	9	27
Oats.....	1	2	10			
Rye.....				1	1.5	8
Purchased:						
Potatoes.....				1	1.35	5
Total succulent feed	.....	626.55	\$1,979	.....	4,150.78	\$20,533

TABLE 45. DRY FORAGE FED IN PASTURE AND WINTER PERIODS, 2058 COWS

Kind of feed	Pasture period			Winter period		
	Number of herds using	Number of tons used	Value	Number of herds using	Number of tons used	Value
Home-grown:						
Mixed hay.....	1	2	\$22	130	2,569.3	\$26,392
Timothy hay.....	1	0.5	6	35	445.45	4,820
Clover hay.....				7	86.9	999
Clover hay (second cut).....				5	20.1	247
Alfalfa hay.....				11	42.4	608
Oat hay.....	1	5	50	23	126.05	1,151
Oat and pea hay.....				20	125.2	1,168
Millet hay.....	2	2.25	17	17	85.55	775
Straw fed (oat).....				20	53.75	264
Straw fed (buckwheat).....				5	3.65	14
Corn stover.....	2	4	11	71	656.2	3,688
Purchased:						
Hay.....				11	42.75	465
Cornstalks.....				2	12	25
Total.....		13.75	\$106		4,269.30	\$40,616

milk, or 1 pound of grain and 12 pounds of succulent feed for each pound of butterfat produced.

For each hundred pounds of milk produced in winter, about 44 pounds of grain, 140 pounds of succulent feed, and 144 pounds of dry forage were used. This amounted to 11 pounds of grain, 35 pounds of succulent feed, and 36 pounds of dry forage, per pound of butterfat.

The data are given in table 46:

TABLE 46. FEED USED PER COW PER DAY AND PER UNIT OF PRODUCT, PASTURE AND WINTER PERIODS, 2058 COWS

	Pasture period				Winter period			
	Total	Pounds			Total	Pounds		
		Per cow per day	Per 100 pounds of milk produced	Per pound of butterfat produced		Per cow per day	Per 100 pounds of milk produced	Per pound of butterfat produced
Grain.....	281,432 pounds	0.856	5.2	1.3	2,614,382 pounds	6.007	43.9	11.0
Silage.....	77.00 tons	0.471	2.8	0.7	3,838.9 tons	18.110	129.0	32.2
Other succulent feed.....	549.55 tons	3.359	20.2	5.0	311.88 tons	1.471	10.5	2.6
Dry forage.....	13.75 tons	0.084	0.5	0.1	4,269.3 tons	20.141	143.5	35.8
Days of pasture per cow.....	159		6.0	1.5				
Acres of pasture per cow.....	3.1							

Labor required.—The labor required to take care of cows is much less in summer than in winter, but owing to the fact that work on the dairy competes somewhat with crop work in summer, the time spent in summer

is more valuable. Dairymen are willing to work for less in winter than in summer. The difference in the cost of production for the two seasons as shown here does not take account of this.

An average of 67.2 hours per cow was required in summer (table 47). This is 25 minutes per cow per day, 2.55 hours per hundred pounds of

TABLE 47. LABOR REQUIRED IN PASTURE AND WINTER PERIODS, 2058 COWS

	Total hours	Hours per cow	Minutes per cow per day	Hours per 100 pounds of milk produced	Hours per pound of butterfat produced
Pasture period					
Milking:					
Man.....	70,159	34.1	13	1.29	0.32
Woman.....	8,640	4.2	2	0.16	0.04
Child.....	5,254	2.5	1	0.10	0.02
Total milking.....	84,053	40.8	16	1.55	0.38
Care of cows, product, and utensils:					
Man.....	26,420	12.8	5	0.49	0.12
Woman.....	6,185	3.0	1	0.11	0.03
Child.....	1,775	0.9	.....	0.03	0.01
Hauling feed.....	35	0.1	.....	.....	.....
Other human labor.....	618	0.2	.....	0.01	.....
Total.....	119,086	57.8	22	2.19	0.54
Hauling milk.....	19,254	9.4	3	0.36	0.09
Total.....	138,340	67.2	25	2.55	0.63
Winter period					
Milking:					
Man.....	86,585	42.1	12	1.45	0.36
Woman.....	7,819	3.8	1	0.13	0.03
Child.....	6,897	3.4	1	0.12	0.03
Total milking.....	101,301	49.3	14	1.70	0.42
Care of cows, product, and utensils:					
Man.....	107,157	52.1	15	1.80	0.45
Woman.....	8,285	4.0	1	0.14	0.04
Child.....	3,095	1.5	1	0.05	0.01
Hauling feed.....	4,014	1.9	1	0.07	0.02
Other human labor.....	2,432	1.2	.....	0.04	0.01
Total.....	226,284	110.0	32	3.80	0.95
Hauling milk.....	21,083	10.2	3	0.36	0.09
Total.....	247,367	120.2	35	4.16	1.04

milk, and 0.63 hour per pound of butterfat produced. The time in winter was 120.2 hours per cow, 35 minutes per cow per day, 4.16 hours per hundred pounds of milk, and 1.04 hours per pound of butterfat produced.

Costs and returns.—Feed represented 29 per cent of the cost in summer and 63 per cent of the cost in winter. The value of summer feed used by cows was 30 cents per hundred pounds of milk sold, or 8 cents per pound of butterfat sold, in summer. In winter the value of feed used was \$1.85 per hundred pounds of milk sold, or 47 cents per pound of butterfat sold. The average price received during the winter was 36 cents per hundred pounds of milk, or 9 cents per pound of butterfat, higher than that received during the pasture period. But the additional value of feed used in its production was more than four times the difference in price. The large part of the difference in cost of milk in the pasture and winter seasons is due to the great difference in the cost of feed.

The charge for labor during the pasture season was 33 cents per hundred pounds of milk sold, or 8 cents per pound of butterfat sold. In winter it was 60 cents per hundred pounds of milk sold, or 15 cents per pound of butterfat sold. In summer the feed cost and the labor charge are of about equal importance. But in winter labor made up about one-fifth of the cost, and feed nearly two-thirds.

The average yearly selling price of milk did not equal its cost. But the cost of production was 159 per cent higher in winter than in the pasture period. If labor had been charged at a lower rate in winter, and if the summer period had paid for the feed used during winter to get cows into condition for summer production, and if more of the cows had freshened in the fall, the difference would have been less.

The data for costs and returns for the two periods are given in tables 48 and 49, respectively.

Summer and winter dairies

The intensity of the methods of feeding and of taking care of the dairies in winter is adjusted to the price of milk and feed and to other factors, but most largely to the time of year when most of the cows freshen. The most favorable time for freshening, from an economic standpoint, depends on the size of the herd, the distance to the milk station, the soil, the acreage and the kind of crops grown, the abundance and cost of pasture, the cost of winter feed, the relative prices of milk in different months, and many other factors.

In this investigation no record was made of the time when the cows freshened. In view of this, it became necessary to sort the records according to the proportion of summer and winter milk, in order to study the variations in the intensity of methods. Three groups were made: one to include those herds from which less than 33 per cent of the milk was sold during May, June, and July; a second to include herds from which from 33 to 40 per cent of the milk was sold during these months; and a third to include herds from which more than 40 per cent of the milk was sold during these months. The first group thus includes herds with the greatest

TABLE 48. COSTS FOR PASTURE AND WINTER PERIODS, 2058 COWS

Cost items	Pasture period				Winter period			
	Total	Per cow	Per 100 pounds of milk sold	Per pound of butterfat sold	Total	Per cow	Per 100 pounds of milk sold	Per pound of butterfat sold
Grain.....	\$4,025.00	\$1.96	\$0.08	\$0.02	\$38,833.00	\$18.87	\$0.72	\$0.18
Silage.....	386.00	0.19	0.01	0.00	19,158.00	9.31	0.35	0.09
Other succulent feed.....	1,593.00	0.77	0.03	0.01	1,375.00	0.67	0.03	0.01
Dry forage.....	106.00	0.05	0.00	0.00	40,616.00	19.74	0.75	0.19
Pasture.....	9,338.00	4.54	0.18	0.05	.....	.....	.....	.....
Total feed.....	\$15,448.00	\$7.51	\$0.30	\$0.08	\$99,982.00	\$48.59	\$1.85	\$0.47
Bedding.....	.....	.....	.....	.....	1,673.00	0.81	0.03	0.01
Human labor.....	16,770.20	8.15	0.33	0.08	32,637.80	15.86	0.60	0.15
Horse labor.....	2.40	0.00	0.00	0.00	1,689.45	0.82	0.03	0.01
Hauling milk.....	9,533.20	4.63	0.19	0.05	10,151.59	4.93	0.19	0.05
Use of buildings.....	3,792.34	1.84	0.07	0.02	4,913.35	2.39	0.09	0.02
Use of equipment.....	442.19	0.21	0.01	0.00	572.91	0.28	0.01	0.00
Interest on cows.....	2,900.08	1.41	0.06	0.02	3,757.32	1.83	0.07	0.02
Interest on feed and supplies.....	.....	.....	.....	.....	1,511.50	0.73	0.03	0.01
Bull service.....	858.73	0.42	0.02	0.00	1,112.57	0.54	0.02	0.00
Depreciation, less value of calves at birth	485.28	0.23	0.01	0.00	628.72	0.31	0.01	0.00
Ice, and sawdust for ice.....	1,764.00	0.86	0.03	0.01	.....	.....	.....	.....
Fly protectors.....	259.00	0.13	0.01	0.00	.....	.....	.....	.....
Other miscellaneous costs.....	642.00	0.31	0.01	0.00	831.00	0.40	0.02	0.00
Total.....	\$52,897.42	\$25.70	\$1.04	\$0.26	\$159,461.21	\$77.49	\$2.95	\$0.74

TABLE 49. RETURNS FOR PASTURE AND WINTER PERIODS, 2058 COWS

Returns from	Pasture period					Winter period						
	Pounds of milk	Pounds of butter-fat	Total value	Value per cow	Value per pounds of milk sold	Value per pound of butter-fat sold	Pounds of milk	Pounds of butter-fat	Total value	Value per cow	Value per pounds of milk sold	Value per pound of butter-fat sold
Milk sold:												
May (13 days).....	733,652	28,612	\$ 9,392.63	.....	.....	.....	529,859	20,665	\$ 6,783.57	.....	.....	.....
May (18 days).....	1,277,921	49,839	15,427.53	.....	.....	.....				.....	.....	.....
June.....	1,031,219	41,249	14,038.80	.....	.....	.....				.....	.....	.....
July.....	804,535	32,986	12,468.13	.....	.....	.....				.....	.....	.....
August.....	729,411	30,635	12,322.50	.....	.....	.....				.....	.....	.....
September.....	464,542	19,511	9,107.02	.....	.....	.....				.....	.....	.....
October (19 days).....	.....	.....	.....	.....	.....	.....	293,395	12,322	5,751.81	.....	.....	.....
October (12 days).....	.....	.....	.....	.....	.....	.....	678,288	28,488	13,955.19	.....	.....	.....
November.....	.....	.....	.....	.....	.....	.....	710,820	29,854	14,668.57	.....	.....	.....
December.....	.....	.....	.....	.....	.....	.....	735,854	29,434	14,693.08	.....	.....	.....
January.....	.....	.....	.....	.....	.....	.....	874,841	26,319	12,700.94	.....	.....	.....
February.....	.....	.....	.....	.....	.....	.....	913,750	31,736	14,673.42	.....	.....	.....
March.....	.....	.....	.....	.....	.....	.....	924,341	36,049	13,941.59	.....	.....	.....
April.....	.....	.....	.....	.....	.....	.....	39,957	1,678	918.50	.....	.....	.....
Retail (159 days).....	30,841	1,296	708.94	.....	.....	.....	.....	.....	.....	.....	.....	.....
Retail (206 days).....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
Total.....	5,072,121	204,128	\$73,465.55	\$35.70	\$1.45	\$0.36	5,491,105	216,545	\$98,086.67	\$47.66	\$1.81	\$0.45
Milk products sold.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
Milk used.....	333,665	13,347	\$5,437.21	.....	.....	.....	1,215	903	\$ 342.76	.....	.....	.....
Skimmilk and Buttermilk used.....	27,707	.....	55.55	.....	.....	.....	432,295	17,292	7,044.43	.....	.....	.....
Butter used.....	1,131	962	326.79	.....	.....	.....	110,826	.....	222.21	.....	.....	.....
Cream used.....	200	40	36.13	.....	.....	.....	4,525	3,846	1,307.18	.....	.....	.....
Manure recovered.....	.....	.....	.....	.....	.....	.....	800	160	144.51	.....	.....	.....
Board of cows.....	.....	.....	.....	.....	.....	.....	.....	.....	19,896.64	.....	.....	.....
Hauling milk.....	.....	.....	68.39	.....	.....	.....	.....	.....	52.00	.....	.....	.....
Total.....	362,703	14,349	\$5,924.07	\$2.88	\$0.11	\$0.03	549,661	22,201	\$29,098.34	\$14.14	\$0.54	\$0.14
Grand total.....	5,434,824	218,477	\$79,389.62	\$38.58	\$1.56	\$0.39	5,950,766	238,746	\$127,185.01	\$61.80	\$2.35	\$0.59
Difference (costs less returns).....	.....	.....	+\$26,492.20	+\$12.88	+\$0.52	+\$0.13	.....	.....	-\$32,276.20	-\$15.69	-\$0.60	-\$0.15
Cost at market.....	.....	.....	\$46,973.35	.....	\$0.93	\$0.23	.....	.....	\$130,362.87	.....	\$2.41	\$0.60

tendency toward winter dairying, producing about 54 per cent of the milk in the six months from November to April inclusive. These herds produced milk distributed by seasons, but not by months, about as needed in the New York market. Some of the cows freshened in the spring, but many of them freshened in the fall. The last group included largely summer dairies producing about 30 per cent of the milk in the six winter months from November to April inclusive. Probably most of the cows in these herds freshened in the spring. The middle group is made up of herds with a lesser tendency toward either winter or summer dairying.

Pounds of milk
sold per cow
per month.

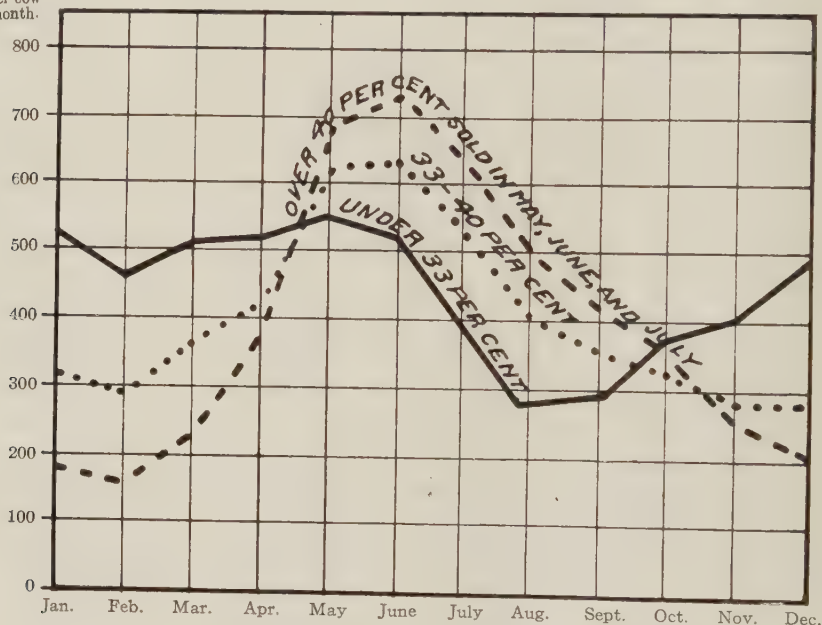


FIG. 59. DISTRIBUTION OF PRODUCTION IN SUMMER AND WINTER DAIRIES

Farms producing more summer milk were smaller and had smaller herds. They were about as heavily stocked, however, as farms on which a larger proportion of the milk was made in winter. The distance to market was much the same, but more of the summer dairies were on the uplands.

The hill sections are unfavorable to the cheapest production of silage, principally because of a shorter growing season and poor soil. It is therefore to be expected that a smaller proportion of the summer dairies should feed silage. This influences the intensity of winter feeding, and thus, to some extent, the proportion of milk made in summer. Probably many of the summer dairies are too small to make profitable use of a silo.

A larger proportion of winter dairies used purebred bulls. This is another indication of a more intensive system.

The relation of the season of production to various factors is shown in table 50:

TABLE 50. RELATION OF SEASON OF PRODUCTION TO VARIOUS FACTORS

	Per cent of milk sold during May, June, and July		
	Less than 33	From 33 to 40	More than 40
Number of farms.....	56	52	41
Acres per farm.....	168	156	142
Miles to market.....	3.5	3.2	3.4
Number of farms on upland.....	31	34	34
Number of farms in valleys.....	25	18	7
Per cent of farms on upland.....	55	65	83
Per cent of farms in valleys.....	45	35	17
Number of cows.....	798	757	503
Cows per farm.....	14.2	14.6	12.3
Number of cattle units.....	1,045.6	959.1	665.6
Cattle units per farm.....	18.7	18.4	16.2
Number using purebred bulls.....	18	12	9
Per cent using purebred bulls.....	32	23	22
Number feeding silage.....	34	25	10
Per cent feeding silage.....	61	48	24
Value of cows per head.....	\$66.61	\$62.72	\$64.63

Production per cow and its distribution.— Production was better in herds that produced a larger proportion of milk in winter. This was due largely to fall freshening and to more intensive feeding rather than to more efficient cows, altho it is probable that better cows were kept.

Per cent of total

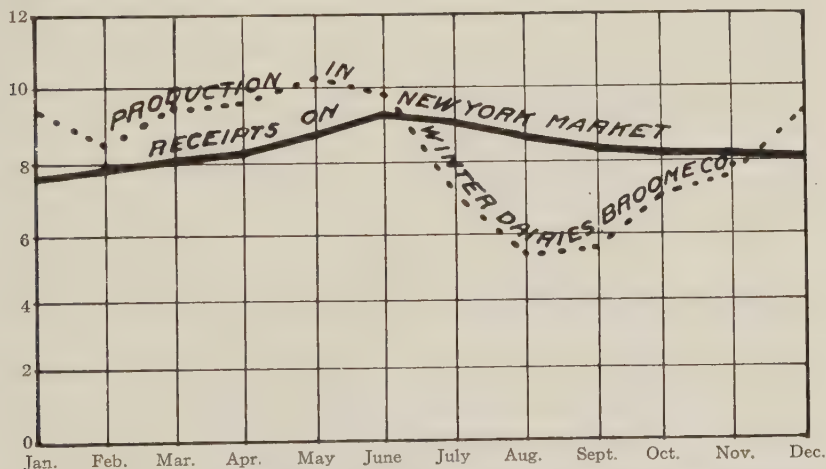


FIG. 60. PRODUCTION IN WINTER DAIRIES IN BROOME COUNTY AS COMPARED WITH RECEIPTS ON THE NEW YORK MARKET

In winter dairies the lowest production comes in August and September, when summer herds also are falling off rapidly

TABLE 51. RELATION OF SEASON OF PRODUCTION TO PRODUCTION AND ITS DISTRIBUTION

	Less than 33 per cent of milk sold during May, June, and July					From 33 to 40 per cent of milk sold during May, June, and July					More than 40 per cent of milk sold during May, June, and July				
	Pounds of milk per cow	Per cent of milk sold	Average per cent of butter- fat	Pounds of butter- fat per cow	Per cent of receipts for milk sold	Pounds of milk per cow	Per cent of milk sold	Average per cent of butter- fat	Pounds of butter- fat per cow	Per cent of receipts for milk sold	Pounds of milk per cow	Per cent of milk sold	Average per cent of butter- fat	Pounds of butter- fat per cow	Per cent of receipts for milk sold
Milk sold:															
May.....	554	10.3	3.9	21.6	7.9	626	12.6	3.9	24.4	9.9	691	14.4	3.9	26.9	11.6
June.....	526	9.7	4.0	21.0	7.0	641	12.9	3.9	25.0	9.7	731	15.4	4.0	29.6	11.9
July.....	383	7.1	4.0	15.3	5.6	534	10.8	4.0	21.4	8.1	630	13.3	4.0	25.6	11.7
August.....	202	5.4	4.1	12.0	5.0	415	8.4	4.1	17.0	8.1	531	10.0	4.1	21.0	10.5
September.....	205	5.5	4.2	12.4	5.5	369	7.5	4.2	15.5	7.8	328	8.0	4.3	18.4	9.5
October.....	387	7.2	4.1	15.9	8.3	347	7.0	4.2	14.6	8.5	370	7.7	4.3	15.9	9.6
November.....	410	7.6	4.1	16.8	9.2	295	6.0	4.1	12.1	7.6	255	5.3	4.4	11.2	7.0
December.....	484	9.0	4.2	20.3	10.8	293	5.9	4.1	12.0	7.5	208	3.7	4.5	9.2	5.7
January.....	513	9.5	4.0	28.5	11.1	312	6.3	4.0	12.5	7.7	180	3.2	4.5	8.1	4.8
February.....	405	8.6	3.9	28.1	9.0	298	6.0	3.8	11.3	6.9	155	3.2	4.0	6.2	3.9
March.....	514	9.5	4.0	20.6	10.1	371	7.5	3.9	14.5	8.4	242	5.0	3.8	9.4	5.8
April.....	516	9.6	4.0	20.6	8.6	423	8.5	3.9	16.5	7.9	383	8.0	3.8	14.6	7.5
Retain.....	53	1.0	4.1	2.2	1.3	28	0.6	4.3	1.2	0.8	15	0.3	4.1	0.6	0.5
Total.....	5,392	100.0	4.0	217.3	100.0	4,952	100.0	4.0	198.0	100.0	4,815	100.0	4.1	196.7	100.0
Milk not sold:															
.....	430	.....	4.0	17.2	.....	460	.....	4.0	18.4	.....	440	.....	4.1	18.0	.....
Total.....	5,822	.....	.....	234.5	.....	5,412	.....	.....	216.4	.....	5,255	.....	.....	214.7	.....

In winter dairies the average production was 5822 pounds of milk containing 234.5 pounds of butterfat, and in summer dairies it was 5255 pounds of milk and 214.7 pounds of butterfat (table 51).

As much milk per cow was produced in November, December, and January, as in May, June, and July, in winter dairies, while in summer dairies the amount was less than one-third as much in the winter months. The average test was higher in the summer dairies, especially in the winter months.

Feed used.—The amounts and kinds of feeds used in relation to season of production are shown in tables 52 to 56.

Less grain and less succulent feed, but more dry forage, was used per cow and per unit of product when a larger proportion of the milk was produced in summer. More of the feed for summer dairies was furnished by pasture. When a summer system is followed, many of the cows give little or no milk in winter. They are kept very largely on dry fodder, with only enough grain to get them in fair condition for spring freshening. This is the cheapest way to produce milk. But milk produced on this system becomes an important factor on the market in April, and thus the April price is lower than the price for the other months of barn feeding. Such a system is common in cheese and butter sections, and to a less extent in condensing sections, because these products are made largely in summer and stored for winter use. However, only a few dairies furnishing milk for city markets follow the summer system, because cities use about the same amount of milk the year round. To produce milk on such a basis is more costly, and hence consumers cannot expect market milk to be as cheap as milk for manufacturing purposes. It has been estimated that in 1918, 47 per cent of the liquid milk sold in New York State was manufactured.¹⁰ The prices which producers receive must compensate for the greater expense in producing certified, retail, Grade A, or Grade B milk, or else such producers will turn to less expensive systems.

Summer dairies use much more feed in winter per unit of product, but they also use much less in summer, so that the yearly average is less than for winter dairies.

Labor required.—The total amounts and value of labor used per cow and per unit of product in herds of varying season of production are given in tables 57 to 59.

Less time was spent per cow in summer dairies than in winter dairies. But since the production also was less, nearly as much time was required per unit of product as when more of the milk was made in winter. An average of 22 minutes per cow per day in summer, and 36 minutes in winter, was used in herds following winter dairying. In the summer dairies these figures were 23 minutes in summer and 29 minutes in winter.

¹⁰ Bulletin 118, New York State Department of Farms and Markets.

TABLE 52. CONCENTRATES USED BY COWS IN THREE SEASONAL GROUPS

Kind of feed	Less than 33 per cent of milk sold during May, June, and July						From 33 to 40 per cent of milk sold during May, June, and July						More than 40 per cent of milk sold during May, June, and July					
	Pasture period			Winter period			Pasture period			Winter period			Pasture period			Winter period		
	Num-ber of herds using	Num-ber of pounds used	Value	Num-ber of herds using	Num-ber of pounds used	Value	Num-ber of herds using	Num-ber of pounds used	Value	Num-ber of herds using	Num-ber of pounds used	Value	Num-ber of herds using	Num-ber of pounds used	Value	Num-ber of herds using	Num-ber of pounds used	Value
Home-grown:																		
Oats.....				9	19,922	\$306				11	41,285	\$612				7	8,300	\$125
Buckwheat.....				7	13,760	235				5	7,960	127				4	3,500	61
Corn.....				1	840	11				3	9,700	184				2	3,100	40
Rye.....				1	1,250	22				1	2,240	50						
Barley.....				1	1,250													
Total home-grown.....					35,772	\$574					61,185	\$923					14,900	\$225
Purchased:																		
Gluten (feed).....	22	29,570	\$454	51	431,570	\$6,562	18	48,909	\$792	46	332,356	\$5,030	14	28,530	\$437	37	200,980	\$3,059
Cornmeal.....	4	2,280	36	16	43,655	708	2	2,100	34	18	48,810	784				14	28,615	462
Hominy.....										8	1,570	26	1	8,300	124	2	10,625	161
Corn and oats.....																		
Corn bran.....	1	2,850	11															
Corn middlings.....	1	1,880	17															
Wheat feed.....	12	14,330	220	22	109,125	1,665	8	15,610	239	25	110,431	1,711	11	19,700	309	22	94,740	1,467
Wheat bran.....	8	6,680	94	28	102,470	1,465	8	11,050	157	18	79,185	1,135	4	2,870	42	17	32,500	406
Wheat middlings.....				2	1,700	27				4	5,850	88				1	100	2
Buckwheat middlings.....	1	3,100	50	2	16,900	265				3	5,000	73						
Ground oats.....				1	3,400	54												
Cottonseed meal.....	6	2,880	47	34	99,367	1,627	3	4,250	70	20	49,744	812	1	600	10	13	23,200	382
Oilmeal.....				6	2,200	67				9	3,900	75				7	1,560	32
Distillers' and brewers' dried grains:																		
Continental gluten.....				2	18,300	366												
Dreg's.....	2	1,800	29	5	23,000	377	1	1,800	30	2	3,260	55						
Kind not found.....	1	250	4	8	4,030	63	1	450	8	3	9,050	151						
Dry equivalent of brewers' grains, wet.....													1	1,000	16	2	3,500	60
Brewers' grains, dried.....	2	20,808	205	205	33,398	255												
Malt sprouts.....	1	1,800	24	9	54,315	757	1	1,080	15	7	17,590	249	2	1,160	16	8	12,730	181
Molasses and molasses feeds:																		
Molasses.....				2	3,700	42				1	1,000	14						
Cloverleaf Feed.....	8	2,880	38	9	40,375	526	1	1,100	15	7	25,035	327				4	4,400	51
Hammond's Dairy.....				2	8,730	116										1	3,300	44
Ideal.....																		
International Special Purina.....																		
Sucrose.....																1	7,850	130

Xtra-Vim	1	2,000	321																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																													
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TABLE 54. DRY FORAGE USED BY COWS IN THREE SEASONAL GROUPS

Kind of feed	Less than 33 per cent of milk sold during May, June, and July						From 33 to 40 per cent of milk sold during May, June, and July						More than 40 per cent of milk sold during May, June, and July					
	Pasture period			Winter period			Pasture period			Winter period			Pasture period			Winter period		
	Num- ber of herds using	Num- ber of herds using	Value	Num- ber of herds using	Num- ber of tons used	Value	Num- ber of herds using	Num- ber of herds using	Value	Num- ber of herds using	Num- ber of tons used	Value	Num- ber of herds using	Num- ber of herds using	Value	Num- ber of herds using	Num- ber of tons used	Value
Home-grown:																		
Alfalfa hay.....	1	2	\$22	45	934.4	\$9,561	...	...	...	46	939.75	\$9,922	...	...	...	39	695.15	\$6,909
Timothy hay.....	1	0.5	6	18	236.05	2,572	...	...	...	11	141.7	1,497	...	...	...	6	67.7	751
Clover hay.....	...	...	...	4	72.3	858	...	...	...	2	12.6	121	...	...	...	1	2	20
Clover hay (second cut).....	...	...	...	2	11	150	...	...	...	3	9.1	97	...	...	...	...	...	...
Alfalfa hay.....	...	...	...	8	32.4	485	...	...	...	1	3	45	...	...	...	...	...	...
Oat hay.....	...	...	...	11	59.75	549	...	...	...	5	23.5	232	...	...	...	2	7	78
Oat and pea hay.....	...	...	...	8	53.2	502	...	...	...	8	53.5	491	...	...	...	7	42.8	370
Millet hay.....	1	0.25	1	8	29.25	285	...	...	...	5	19.3	184	...	1	2	4	18.5	175
Bat straw.....	...	...	...	5	11	72	...	...	...	9	16.75	93	...	...	...	6	26	306
Buckwheat straw.....	...	...	...	1	1	3	...	...	...	3	1.65	1	...	...	...	1	1	99
Corn stover.....	1	3	6	23	229.5	1,291	...	...	...	26	227.05	1,326	...	1	1	22	190.65	1,071
Purchased:																		
Hay.....	...	...	...	3	14.25	161	...	...	...	4	12.5	127	...	...	...	4	16	177
Crust-thills.....	...	...	...	2	12	75	...	...	...	...	...	...	...	...	...	...	...	...
Total dry forage.....	5.75	...	\$35	...	1,696.1	\$16,514	...	5	\$50	...	1,460.4	\$14,141	...	3	\$21	...	1,112.8	\$9,961
Total for year.....	1,701.85 tons, value \$16,549						1,465.4 tons, value \$14,191						1,115.8 tons, value \$9,982					

TABLE 55. AMOUNTS OF FEED USED PER COW AND PER UNIT OF PRODUCT IN THREE SEASONAL GROUPS

	Less than 33 per cent of milk sold during May, June, and July*			From 33 to 40 per cent of milk sold during May, June, and July			More than 40 per cent of milk sold during May, June, and July		
	Pounds			Pounds			Pounds		
	Per cow	Per 100 pounds of milk pro- duced	Per pound of but- terfat produced	Per cow	Per 100 pounds of milk pro- duced	Per pound of but- terfat produced	Per cow	Per 100 pounds of milk pro- duced	Per pound of but- terfat produced
Grain.....	1,668	28.6	7.2	1,310	24.2	6.0	1,140	21.7	5.3
Silage.....	5,592	96.1	24.0	3,555	65.7	16.4	1,268	24.1	5.9
Other succulent feed.....	858	14.7	3.7	938	17.3	4.3	732	13.9	3.4
Dry forage.....	4,265	73.3	18.3	3,872	71.5	17.9	4,437	84.4	20.6
Days of pasture.....	158	2.7	.....	160	3.0	.....	161	3.1	.....
Acres of pasture.....	3.1	.....	.....	2.9	.....	.....	3.4	.....	.....

* The data for this group of herds were used with data for other regions in the "Warren formula" averages, as given in Circular 186, New York State Department of Farms and Markets, April, 1919, pages 4-5.

TABLE 56. AMOUNTS OF FEED USED PER 100 POUNDS OF MILK IN PASTURE AND WINTER PERIODS IN THREE SEASONAL GROUPS

	Less than 33 per cent of milk sold during May, June, and July	From 33 to 40 per cent of milk sold dur- ing May, June, and July	More than 40 per cent of milk sold dur- ing May, June, and July
Pasture period:			
Grain.....	6.2	4.9	4.3
Silage.....	6.6	1.8	.....
Other succulent feed.....	22.0	21.6	16.4
Dry forage.....	0.6	0.5	0.4
Winter period:			
Grain.....	42.6	43.9	47.5
Silage.....	151.9	133.1	59.9
Other succulent feed.....	10.2	11.0	10.3
Dry forage.....	118.5	144.2	209.1

Excluding milk hauling, the average time spent in summer was 2.56 hours per hundred pounds of milk produced for winter dairies, and 2 hours for summer dairies. In winter the average time was 3.49 hours and 4.72 hours, respectively. Hauling the milk increased these figures 0.28 hour for winter dairies and 0.44 hour for summer dairies.

A larger proportion of the labor is done by women and children on summer than on winter dairies. The time spent by women and children averaged 19.1 hours, 25.3 hours, and 27.1 hours, per cow for the respective groups.. This was respectively 10.4 per cent, 16.2 per cent, and 16.6 per cent, of the total time spent per cow. Most of the extra work was in milking, the time in taking care of dairy utensils, product, and cows being about the same for each group. Since this woman and child labor was charged

TABLE 57. LABOR USED FOR COWS IN THREE SEASONAL GROUPS

	Less than 33 per cent of milk sold during May, June, and July			From 33 to 40 per cent of milk sold during May, June, and July			More than 40 per cent of milk sold during May, June, and July		
	Number of farms using	Number of hours	Value	Number of farms using	Number of hours	Value	Number of farms using	Number of hours	Value
Human labor:									
Milking:									
Man.....	56	69,277	\$10,391.55	52	52,247	\$ 7,837.05	41	35,220	\$ 5,283.00
Woman.....	6	2,987	298.70	15	6,897	689.70	16	6,575	657.50
Child.....	9	4,586	458.60	11	4,595	459.50	6	2,970	297.00
Care of cows, product, and utensils:									
Man.....	56	57,053	8,557.95	51	44,722	6,708.30	41	31,802	4,770.30
Woman.....	41	4,692	469.20	46	5,922	592.20	34	3,856	385.60
Child.....	8	2,949	294.90	7	1,732	173.20	3	189	18.90
Hauling feed.....	44	2,018	302.70	34	1,182	177.30	25	849	127.35
Hauling milk:									
Man.....	30	11,930	1,789.50	28	14,078	2,111.70	30	10,689	1,603.35
Woman.....	1	60	6.00	3	442	44.20	5	506	50.60
Child.....	3	996	99.60	3	1,090	109.00	1	546	54.60
Other human labor.....	15	2,084	312.60	11	583	87.45	6	383	57.45
Total labor for cows:									
Man.....		142,362	21,354.30	....	112,812	16,921.80	....	78,943	11,841.45
Woman.....		7,739	773.90	....	13,261	1,326.10	....	10,937	1,093.70
Child.....		8,531	853.10	....	7,417	741.70	....	3,705	370.50
Total human labor.....		158,632	\$22,981.30	....	133,490	\$18,989.60	....	93,585	\$13,305.65
Horse labor:									
Hauling milk.....		18,522	\$2,778.30	....	22,587	\$3,388.05	....	17,281	\$2,592.15
Other horse labor.....		5,260	789.00	....	3,621	543.15	....	2,398	359.70
Total horse labor.....		23,782	\$3,567.30	....	26,208	\$3,931.20	....	19,679	\$2,951.85
Cash paid for hauling milk.....	38	.....	\$2,304.35	29	.....	\$1,767.33	20	.....	\$986.06

TABLE 58. LABOR PER COW AND PER UNIT OF PRODUCT IN THREE SEASONAL GROUPS

	Less than 33 per cent of milk sold during May, June, and July			From 33 to 40 per cent of milk sold during May, June, and July			More than 40 per cent of milk sold during May, June, and July		
	Hours per cow	Hours per 100 pounds of milk produced	Hours per pound of butterfat produced	Hours per cow	Hours per 100 pounds of milk produced	Hours per pound of butterfat produced	Hours per cow	Hours per 100 pounds of milk produced	Hours per pound of butterfat produced
Human labor:									
Milking:									
Man.....	86.8	1.49	0.37	69.0	1.28	0.32	70.0	1.33	0.33
Woman.....	3.7	0.06	0.02	9.1	0.17	0.04	13.1	0.25	0.06
Child.....	5.8	0.10	0.02	6.1	0.11	0.03	5.9	0.12	0.03
Total.....	96.3	1.65	0.41	84.2	1.56	0.39	89.0	1.70	0.42
Care of cows, product, and utensils:									
Man.....	71.5	1.23	0.31	59.1	1.09	0.27	63.2	1.20	0.30
Woman.....	5.9	0.10	0.02	7.8	0.14	0.04	7.7	0.15	0.03
Child.....	3.7	0.06	0.02	2.3	0.04	0.01	0.4	0.01	0.00
Hauling feed.....	2.5	0.05	0.01	1.5	0.03	0.01	1.7	0.03	0.01
Other human labor.....	2.6	0.05	0.01	0.8	0.02	.....	0.7	0.01	.....
Total.....	182.5	3.14	0.78	155.7	2.88	0.72	162.7	3.10	0.76
Hauling milk.....	16.3	0.28	0.07	20.6	0.38	0.09	23.3	0.44	0.11
Total human labor.....	198.8	3.42	0.85	176.3	3.26	0.81	186.0	3.54	0.87
Horse labor:									
Hauling milk.....	23.2	0.40	0.10	29.8	0.55	0.14	34.3	0.65	0.16
Other horse labor.....	6.6	0.11	0.03	4.8	0.09	0.02	4.8	0.09	0.02
Total horse labor.....	29.8	0.51	0.13	34.6	0.64	0.16	39.1	0.74	0.18

TABLE 59. LABOR IN PASTURE AND WINTER PERIODS BY SEASONAL GROUPS

	Less than 33 per cent of milk sold during May, June, and July				From 33 to 40 per cent of milk sold during May, June, and July				More than 40 per cent of milk sold during May, June, and July			
	Total hours	Hours per cow	Hours per 100 pounds of milk produced	Minutes per day	Total hours	Hours per cow	Hours per 100 pounds of milk produced	Minutes per day	Total hours	Hours per cow	Hours per 100 pounds of milk produced	Minutes per day
Pasture period:												
Milking:												
Man.....	28,849	36.1		14	23,842	31.5		12	17,468	34.7		13
Woman.....	1,427	1.8		1	3,536	4.1		2	3,677	7.3		3
Child.....	1,916	2.4		1	2,438	2.8		1	1,200	2.4		1
Total.....				16				15				17
Care of cows, product, and utensils:												
Man.....	10,267	12.9		5	8,097	11.8		5	7,216	14.4		5
Woman.....	1,963	2.5		1	2,438	3.2		1	1,784	3.5		1
Child.....	813	1.0			773	1.0			189	0.4		
Total.....												
Hauling feed.....												
Other human labor.....	472	0.6			35							
Total.....	45,707	57.3	2.56	22	41,780	55.2	2.02	21	31,590	62.8	2.00	23
Winter period:												
Milking:												
Man.....	40,428	50.7		15	28,405	37.5		11	17,752	35.3		10
Woman.....	1,560	2.0		1	3,361	4.4		1	2,808	5.8		2
Child.....	2,670	3.3		1	2,457	3.3		1	1,770	3.5		1
Total.....				17				13				13
Care of cows, product, and utensils:												
Man.....	46,786	58.6		17	35,815	47.3		14	24,556	48.8		14
Woman.....	2,720	3.4		1	3,484	4.6		1	2,072	4.1		1
Child.....	2,136	2.7		1	959	1.3						
Total.....												
Hauling feed.....												
Other human labor.....	2,018	2.5			1,147	1.5		1	840	1.7		1
Total.....	99,939	125.2	3.49	36	76,001	100.5	3.70	29	50,254	99.9	4.72	29

at a lower rate than man labor, it tends to reduce the cost of labor for the summer herds. By thus working the whole family, it is often possible to save the expense of a hired man. Should these summer dairies back on the hills attempt winter dairying instead, in many cases the size of the herd would have to be reduced in order to be carried thru on the roughage that the farm would provide. This would mean that pasture would not be utilized to the fullest extent, and probably that more hired labor would be needed. It would mean also that it would be necessary not only for one, but for many, of these dairies to change in order to justify a special trip thru the section for the milk in parts of the winter. Under these circumstances it is a question whether a change to winter dairying with the prices prevailing when this study was made would increase the profits on the farms studied.

Combined effect of size of herd and season of production on labor required.— Since less labor is required in large herds and when a large proportion of the milk is produced in summer, it is to be expected that in the larger summer dairies the least labor per cow and per unit of product will be necessary. The data on this subject are given in table 60:

TABLE 60. RELATION OF SIZE OF HERD AND SEASON OF PRODUCTION TO LABOR PER COW AND PER UNIT OF PRODUCT

Per cent of milk sold during May, June, and July	Number of cows per farm							
	6 to 10		10+ to 14		14+ to 18		Over 18	
	Hours per cow	Hours per 100 pounds of milk produced	Hours per cow	Hours per 100 pounds of milk produced	Hours per cow	Hours per 100 pounds of milk produced	Hours per cow	Hours per 100 pounds of milk produced
Less than 33 per cent:								
Hauling milk.....	15	0.25	16	0.30	22	0.42	14	0.23
Other labor.....	202	3.39	197	3.66	186	3.54	161	2.57
Total.....	217	3.64	213	3.96	208	3.96	175	2.80
From 33 to 40 per cent:								
Hauling milk.....	29	0.55	14	0.27	31	0.57	16	0.29
Other labor.....	186	3.51	167	3.16	150	2.78	139	2.50
Total.....	215	4.06	181	3.43	181	3.35	155	2.79
More than 40 per cent:								
Hauling milk.....	20	0.40	36	0.67	24	0.44	7	0.12
Other labor.....	199	4.02	170	3.19	136	2.51	125	2.33
Total.....	219	4.42	206	3.86	160	2.95	132	2.45

Other costs and returns by seasonal groups.— Details for costs other than feed and labor, and of the returns for summer and winter dairies, are given in tables 61 to 74.

Cows had a higher value, higher prices were paid for cows purchased, and more was received for cows sold, when the system was more intensive.

Cows are replaced more frequently in winter dairies than in summer dairies. More heifers per hundred cows freshen each year, and more

cows are purchased, in winter dairies. A larger share of the cows sold from winter dairies go to the butcher. The size of the winter herds on the farms studied increased; in summer dairies there were less cows at the end of the year than at the beginning.

TABLE 61. COST OF PASTURE

	Less than 33 per cent of milk sold during May, June, and July		From 33 to 40 per cent of milk sold during May, June, and July		More than 40 per cent of milk sold during May, June, and July	
Acres pastured.....	3,215.5		2,572		2,140	
Value per acre.....	\$21.44		\$19.84		\$18.95	
Total value.....	\$68,945		\$51,018		\$40,546	
Days pastured.....	158		160		161	
	Number of farms	Value	Number of farms	Value	Number of farms	Value
Charges:						
Interest and taxes at 5.5 per cent	56	\$3,792	52	\$2,806	41	\$2,230
Making and repairing fences.....	56	890	51	939	40	566
Mowing and reseeding.....	3	46	2	23	.....	.....
Fertilizing and manuring.....	.....	.....	1	90	1	75
Pasture rented.....	17	348	15	240	13	205
Total charges.....	.....	\$5,076	.....	\$4,098	.....	\$3,076
Received for pasture.....	12	198	5	37	3	70
Difference (= cost of pasture).....	.....	\$4,878	.....	\$4,061	.....	\$3,006
Credited for horses, colts, and sheep pastured.....	19	163	20	60	21	131
Difference (= charge to cattle).....	.....	\$4,715	.....	\$4,001	.....	\$2,875
Cows' share, based on proportion of equivalent in total animal units pastured for entire season represented by cows pastured.....	.....	\$3,665	.....	\$3,353	.....	\$2,320

A larger proportion of the calves born in summer dairies are raised, than in herds producing more milk in winter. In winter dairies (the first group), 58 per cent of the calves were vealed or deaconed, in the second group 56 per cent were vealed or deaconed, and in summer herds 52 per cent were vealed or deaconed. In the first group, 35 per cent of the calves born during the year were heifers to be raised at home or elsewhere; in the second group this figure was 38 per cent; and in the third group, largely composed of summer dairies, it was 41 per cent. The raising of more heifer calves from the lower-producing summer dairies operates to keep down the average production of cows in the State.

Practically all of the costs are higher when a larger proportion of the milk is produced in winter. In other words, the system is more intensive thruout, but especially so in regard to feeding.

TABLE 62. COST OF BEDDING USED

Kind of bedding	Less than 33 per cent of milk sold during May, June, and July		From 33 to 40 per cent of milk sold during May, June, and July		More than 40 per cent of milk sold during May, June, and July	
	Number of farms using	Value of bedding	Number of farms using	Value of bedding	Number of farms using	Value of bedding
Home-grown:						
Oat straw.....	33	\$363	35	\$526	24	\$282
Buckwheat straw.....	7	33	7	52	8	16
Wheat straw.....	.....	.....	.....	.....	1	2
Rye straw.....	1	18	.....	.....	.....	.....
Chaff.....	.....	.....	4	9	2	8
Swamp and marsh hay.....	2	13	2	9	1	18
Sawdust.....	3	4	4	16	1	2
Total home-grown.....	....	\$431	....	\$612	....	\$328
Purchased:						
Sawdust.....	21	\$152	20	\$74	10	\$49
Shavings.....	3	12	.....	.....	2	6
Buckwheat straw.....	1	2	.....	.....	.....	.....
Oat straw.....	1	2	.....	.....	1	5
Total purchased.....	....	\$168	....	\$74	....	\$60
Total bedding.....	....	\$599	....	\$686	....	\$388

The value of feed, except pasture used in the winter dairies, was \$60.44 per cow, and in the summer dairies it was \$41.54 per cow. The value of labor was about \$3 less per cow in the latter group. The cows were valued at less, and less feed was kept on hand, and so the interest was less. Also, as is discussed later, the cost of keeping herd bulls was less. The distance to the milk stations is greater for the summer dairies, and this, together with the fact that the herds were smaller and the production was less, made the charges for milk hauling higher. The total costs per cow were \$117.32, \$100.81, and \$93.51, respectively, for the three groups.

Not only was the production less in the summer dairies, but, owing to the fact that a large proportion of the milk was sold in the months when the prices were lowest, the average price for the year was 18 cents less than for winter dairies. Hence the differences in the receipts per cow from milk sold were greater than the differences in production.

At the average price of \$1.72 per hundredweight, the milk sold from winter dairies amounted to \$92.99 per cow; at \$1.60, the average price in the middle group, it was \$79.22; and at \$1.54, the price for summer dairies, it was \$74.30.

TABLE 63. CHARGES FOR USE OF BUILDINGS

	Less than 33 per cent of milk sold during May, June, and July				From 33 to 40 per cent of milk sold during May, June, and July				More than 40 per cent of milk sold during May, June, and July			
	Num-ber of farms	Value of buildings at beginning	Num-ber of farms	Value of buildings at end	Num-ber of farms	Value of buildings at beginning	Num-ber of farms	Value of buildings at end	Num-ber of farms	Value of buildings at beginning	Num-ber of farms	Value of buildings at end
Dairy and cattle barns	56	\$38,397	56	\$57,800	52	\$45,384	52	\$46,290	41	\$23,831	41	\$24,487
Silos	27	5,152	31	5,707	10	2,005	19	2,555	8	1,175	10	1,315
Milk houses	43	1,918	43	1,900	42	1,330	44	1,467	37	1,454	37	1,454
Ice houses	33	1,324	34	1,352	33	1,515	33	1,505	28	653	28	650
Total	.....	\$66,791	.....	\$66,759	.....	\$50,840	.....	\$51,817	.....	\$27,115	.....	\$28,106
Average value	.....	\$66,775.00	.....	\$66,775.00	.....	\$51,329.00	.....	\$51,817.00	.....	\$27,610.00	.....	\$28,106.00
Interest at 5 per cent	.....	3,338.75	.....	3,338.75	.....	2,566.45	.....	2,566.45	.....	1,380.50	.....	1,380.50
Decrease in value	.....	32.00	.....	32.00	.....	.....	.....	.....	.....	.....	.....	.....
Insurance	.....	205.00	.....	205.00	.....	167.00	.....	167.00	.....	83.00	.....	83.00
Repairs and new buildings:	Number of farms	Cost of repairs	Number of farms	Cost of repairs	Number of farms	Cost of repairs	Number of farms	Cost of repairs	Number of farms	Cost of repairs	Number of farms	Cost of repairs
Purchased lumber	3	\$ 26.50	4	\$260.00	4	\$260.00	4	\$260.00	..	\$	..	\$
Shingles and roofing	5	108.50	10	444.50	10	444.50	10	444.50	3	12.00	3	12.00
Paint and glass	19	175.70	17	248.00	17	248.00	17	248.00	4	4.00	4	4.00
Hardware	1	6.60	2	113.00	2	113.00	2	113.00	..	.....	..	.....
Materials from farms	9	288.50	6	74.00	6	74.00	6	74.00	2	02.00	2	02.00
Sand and gravel	4	16.75	1	2.00	1	2.00	1	2.00	1	2.50	1	2.50
Cement	4	31.00	3	158.50	3	158.50	3	158.50	2	10.90	2	10.90
Labor:												
Hired	9	391.20	7	526.25	7	526.25	7	526.25	2	25.00	2	25.00
Farm	12	170.16	8	313.50	8	313.50	8	313.50	6	32.50	6	32.50
Horse	3	28.20	2	25.00	2	25.00	2	25.00	2	21.00	2	21.00
Board of labor	4	13.50	1	5.00	1	5.00	1	5.00	1	8.00	1	8.00
New buildings, labor and materials	4	319.60	2	34.90	2	34.90	2	34.90	4	1,557.00	4	1,557.00
Total	37	\$1,570.21	33	\$2,205.55	33	\$2,205.55	33	\$2,205.55	16	\$1,734.90	16	\$1,734.90
Increase in value	.....	.....	.....	.....	.....	\$977.00	.....	\$977.00	.....	\$691.00	.....	\$691.00
Total charged to dairy cattle for use of buildings	.....	.....	.....	.....	.....	\$3,662.00	.....	\$3,662.00	.....	\$2,207.40	.....	\$2,207.40
Cows' share, based on proportion of average total cattle units on hand represented by cows	.....	.....	.....	.....	.....	\$3,142.71	.....	\$3,142.71	.....	\$1,647.21	.....	\$1,647.21

TABLE 64. CHARGES FOR USE OF EQUIPMENT

	Less than 33 per cent of milk sold during May, June, and July				From 33 to 40 per cent of milk sold during May, June, and July				More than 40 per cent of milk sold during May, June, and July			
	Num- ber of farms	Value of equipment at beginning	Num- ber of farms	Value of equipment at end	Num- ber of farms	Value of equipment at beginning	Num- ber of farms	Value of equipment at end	Num- ber of farms	Value of equipment at beginning	Num- ber of farms	Value of equipment at end
Milk cans.....	46	\$435	46	\$422	42	\$355	43	\$347	32	\$250	33	\$228
Coolers.....	5	16	5	15	2	5	3	10	3	9	3	9
Testers, bottles, and scales.....	6	13	7	15	9	24	9	3	2	7	2	7
Separators.....	8	102	8	100	5	149	5	143	2	60	2	80
Churns and containers.....	14	39	14	39	15	24	15	24	11	22	13	22
Bottles and workers.....	2	3	2	3	2	2	2	24	3	6	3	6
Milk wagons.....	31	553	31	495	28	571	29	615	31	586	32	576
Milking machines.....	32	107	32	107	32	78	32	77	27	52	27	50
Ice tools.....	32	107	32	107	32	78	32	77	27	52	27	50
Feed cutters.....	4	10	2	6	3	345	3	320	1	25	1	25
Pumps and root cutters.....	5	408	8	442	3	345	3	320	2	35	3	32
Grinders and engines.....	56	132	56	133	51	101	52	119	40	81	40	80
Milk pails and strainers.....	13	14	14	14	11	11	12	13	7	8	7	7
Extra, calf pails.....	9	50	11	64	8	38	10	48	7	27	7	20
Clipping machines.....	8	16	8	16	1	118	2	114	2	4	3	7
Veterinary outfits.....	52	170	53	178	40	118	36	114	34	72	33	72
Forks, shovels, and other barn tools.....	11	32	12	33	17	45	21	55	13	26	14	26
Wheelbarrows and trucks.....	12	13	9	13	7	7	11	11	3	3	4	4
Stalls and halters.....	56	\$2,113	56	\$2,095	52	\$1,874	52	\$1,924	41	\$1,276	41	\$1,515
Total.....												
Average value.....		\$2,104				\$1,899				\$1,395		
Interest at 5 per cent.....		\$105.20				\$94.95				\$60.75		
Cost of equipment purchased.....		336.00				335.30				498.00		
Repairs.....		74.00				94.00				62.00		
Decreased value.....		18.00				.....				.....		
Total.....		\$533.20				\$524.25				\$539.75		
Increase in value.....		.....				\$50.00				\$239.00		
Total charged to dairy cattle for use of equipment.....		\$533.20				\$474.25				\$300.75		
Cows share, determined by apportioning to cows, heifers, and herd bulls the charge for use of equipment on each farm.....		\$414.75				\$364.05				\$236.30		

TABLE 65. INTEREST CHARGES

	Less than 33 per cent of milk sold during May, June, and July	From 33 to 40 per cent of milk sold during May, June, and July	Over 40 per cent of milk sold during May, June, and July
Interest on cows.....	\$2,657.85	\$2,374.00	\$1,625.55
Interest on feed and supplies kept on hand for cows.....	673.50	516.50	321.50

Manure recovered amounted to 7.2 tons per cow in summer dairies, and 8.2 tons per cow in winter dairies, a difference of 1 ton per cow.

The total returns per cow for the three groups were \$112.85, \$98.45, and \$92.65, respectively. The apparent losses per cow were \$4.47, \$2.36, and \$0.86.

TABLE 66. DEPRECIATION ON COWS

	Less than 33 per cent of milk sold during May, June, and July			From 33 to 40 per cent of milk sold during May, June, and July			More than 40 per cent of milk sold during May, June, and July		
	Number of farms	Number of stock	Value of stock	Number of farms	Number of stock	Value of stock	Number of farms	Number of stock	Value of stock
Cows purchased.....	17	53	\$3,883	18	57	\$3,382	12	24	\$1,355
Heifers that became cows.....	44	158	9,060	31	88	4,757	28	58	3,400
Total value.....			\$12,943			\$8,139			\$4,755
Cows slaughtered or sold for slaughter.....	37	90	\$3,633	30	79	\$2,927	19	39	\$1,449
Cows sold for breeding or production.....	15	44	2,530	14	33	1,650	13	40	2,190
Total value.....			\$6,163			\$4,577			\$3,639
Cow hides sold.....	13	18	\$ 120	15	21	\$ 220	10	11	\$ 81
Increase in inventory of cows.....		60	4,514		8	927		10	135
Decrease in inventory of cows.....									
Cows purchased and heifers that became cows, plus decrease in inventory of cows, less value of cows slaughtered or sold, less sales of cow hides, less increase in inventory of cows (= depreciation on cows).....			\$2,146			\$2,406			\$1,170
Calves born during year, and value at birth:									
Heifers to be raised or sold.....	50	260	\$825	51	271	\$818	39	193	\$580
Bulls to be kept.....	18	19	70	15	17	68	17	18	88
Bulls sold or to be sold.....	20	33	149	12	28	116	10	14	46
Calves vealed or to be vealed.....	51	378	705	49	363	654	37	196	291
Calves deaconed.....	19	73		14	39		18	50	
Deacon hides and carcasses.....	18	69	68	14	39	48	18	50	53
Total calves born alive.....	55	772	\$1,817	51	718	\$1,704	41	471	\$1,067
Calves born dead.....	12	19		16	25		7	9	
Calf hides and carcasses.....	4	6	8	6	12	9	3	3	3
Cows that aborted.....	11	19		7	13		7	9	
Total credited.....			\$1,825			\$1,713			\$1,070
Difference (= cow decrease).....			\$321			\$693			\$100

Since so many of the costs are less, the cost of producing milk or butter-fat is much less, when chiefly summer milk is made. But the price also

is less, and therefore the gain is not proportional to the decrease in cost of production. When the herd cost is considered, the loss per hundred pounds of milk sold was 12 cents for winter dairies, 5 cents for the mixed summer and winter dairies, and nothing for the summer dairies. When the cow cost is considered, the loss was 9 cents, 5 cents, and 2 cents, respectively. A gain on heifers in summer dairies, and a loss on heifers in winter dairies, caused the herd cost of milk to decrease faster than the cow cost. The herd cost of milk per hundred pounds was 30 cents, and the cow cost 25 cents, higher in the winter dairies than in the summer dairies.

TABLE 67. RELATION OF SEASON OF PRODUCTION TO PROPORTION OF COWS REPLACED EACH YEAR

	Less than 33 per cent of milk sold during May, June, and July		From 33 to 40 per cent of milk sold during May, June, and July		More than 40 per cent of milk sold during May, June, and July	
	Total number	Per 100 cows	Total number	Per 100 cows	Total number	Per 100 cows
Cows purchased.....	53	6.6	57	7.6	24	4.8
Heifers that became cows.....	158	19.8	88	11.6	58	11.5
Total.....	211	26.4	145	19.2	82	16.3
Increase in inventory.....	60	.....	8	.....	.....	.....
Decrease in inventory.....	.....	.....	.....	.....	10	.....
Difference.....	151	18.9	137	18.1	92	18.3
Cows slaughtered or sold for slaughter.....	90	11.3	79	10.4	39	7.8
Cows sold for production.....	44	5.5	33	4.4	40	7.9
Number that died.....	17	2.1	25	3.3	13	2.6

TABLE 68. MISCELLANEOUS COSTS

	Less than 33 per cent of milk sold during May, June, and July		From 33 to 40 per cent of milk sold during May, June, and July		More than 40 per cent of milk sold during May, June, and July	
	Number of farms	Value of item	Number of farms	Value of item	Number of farms	Value of item
Ice.....	38	\$620	38	\$662	32	\$429
Veterinary fees.....	17	138	20	110	13	79
Medicines, disinfectants, and louse killers.....	30	94	31	89	21	52
Fly protectors.....	41	84	38	102	28	73
Whitewashing.....	34	132	39	107	32	68
Milk testing, acids, etc.....	8	124	5	64	3	60
Insurance on cows.....	42	68	35	50	27	44
Feed grinding and freight.....	8	19	11	46	7	16
Express on cattle.....	1	1	1	1	.....	.....
Sawdust for ice.....	7	16	5	17	7	20
Hauling feed.....	1	6	1	6	1	2
Hauling bedding.....	1	5	1	10	.....	.....
Gasoline, oil, and batteries.....	1	8	1	13	1	7
Fuel for water heater.....	2	11	.....	.....	.....	.....
Clipping.....	5	8	3	3	4	5
Lime.....	1	1	.....	.....	.....	.....
Board of cows.....	1	26	.....	.....	.....	.....
Total.....	.....	\$1,361	.....	\$1,280	.....	\$855

TABLE 69. QUANTITY AND VALUE OF MILK SOLD

	Less than 33 per cent of milk sold during May, June, and July			From 33 to 40 per cent of milk sold during May, June, and July			More than 40 per cent of milk sold during May, June, and July		
	Number of farms	Number of pounds	Value	Number of farms	Number of pounds	Value	Number of farms	Number of pounds	Value
May.....	56	442,176	\$5,897.44	52	473,701	\$5,947.04	41	347,634	\$4,331.72
June.....	56	420,026	5,188.26	52	484,969	5,783.80	41	372,926	4,455.47
July.....	56	305,332	4,195.75	52	404,604	5,486.65	41	321,283	4,356.40
August.....	55	232,755	3,692.86	52	314,796	4,848.89	41	256,984	3,926.38
September....	56	235,202	4,108.61	52	279,046	4,664.40	41	215,163	3,549.49
October.....	56	309,041	6,122.15	52	262,971	5,123.38	41	185,925	3,613.30
November.....	56	326,953	6,772.02	52	223,126	4,559.12	41	128,209	2,624.05
December.....	56	386,512	8,040.87	51	221,417	4,510.97	40	102,891	2,116.73
January.....	56	409,469	8,256.67	51	236,051	4,635.43	35	90,334	1,800.98
February.....	56	371,416	7,101.62	52	225,219	4,147.84	32	78,206	1,451.48
March.....	56	410,659	7,473.24	51	281,119	5,040.30	33	121,972	2,159.88
April.....	56	411,364	6,380.90	52	320,370	4,749.27	38	192,607	2,811.42
Retail.....	25	41,920	973.90	15	21,074	475.46	13	7,804	178.08
Total.....	.....	4,302,825	\$74,204.29	.....	3,748,463	\$59,972.55	.....	2,421,938	\$37,375.38

TABLE 70. PROPORTION OF MONTHLY MILK PRODUCTION BY SEASONAL GROUPS

	Less than 33 per cent of milk sold during May, June, and July	From 33 to 40 per cent of milk sold during May, June, and July	More than 40 per cent of milk sold during May, June, and July
	Per cent of pounds of milk sold for month		
May.....	35.0	37.5	27.5
June.....	32.9	37.9	29.2
July.....	29.6	39.3	31.1
August.....	29.0	39.1	31.9
September....	32.2	38.3	29.5
October.....	40.8	34.7	24.5
November.....	48.2	32.9	18.9
December.....	54.4	31.1	14.5
January.....	55.6	32.1	12.3
February.....	55.1	33.3	11.6
March.....	50.5	34.5	15.0
April.....	44.4	34.7	20.9
Per cent of total milk sold for year...	41.1	35.8	23.1
Per cent of total number of cows....	38.8	36.8	24.4
Per cent of total number of farms....	37.6	34.9	27.5

TABLE 71. QUANTITY AND VALUE OF MILK AND ITS PRODUCTS USED ON FARMS, AND OF MILK PRODUCTS SOLD

	Less than 33 per cent of milk sold during May, June, and July			From 33 to 40 per cent of milk sold during May, June, and July			More than 40 per cent of milk sold during May, June, and July		
	Number of farms	Number of pounds	Value	Number of farms	Number of pounds	Value	Number of farms	Number of pounds	Value
Milk used:									
Family.....	54	116,315	\$2,002.97	52	119,661	\$1,909.26	41	77,072	\$1,191.10
Hired man.....	8	10,085	180.53	5	7,165	117.50	1	388	6.13
Heifers.....	50	92,009	1,561.61	50	81,603	1,306.89	34	41,852	649.27
Veals and bulls to be sold.....	34	67,761	1,152.40	34	74,622	1,197.78	26	51,152	776.73
Bull calves to be kept for herd bulls.....	24	10,497	181.65	21	8,299	132.70	20	7,479	115.12
Milk products used:									
Skimmilk:									
Hogs.....	2	8,000	13.20	4	16,100	34.15	4	6,600	12.62
Poultry.....	1	2,200	3.30						
Heifers.....	11	31,450	49.03	10	36,120	67.37	11	28,498	54.77
Veals and bulls to be sold.....							4	3,072	6.16
Bull calves to be kept for herd bulls.....	1	2,000	3.00	3	1,780	3.56	4	2,713	4.52
Buttermilk:									
Family use.....	6	2,100	4.60	10	3,514	7.20	5	1,650	4.13
Hogs.....	1	500	1.00	3	750	2.01	6	2,000	4.49
Poultry.....				1	100	0.20			
Heifers.....	2	1,000	1.70				1	300	0.75
Butter, family use.....	13	1,864	556.95	12	2,380	675.60	11	1,412	401.42
Cream, family use.....	2	200	30.00	5	556	101.84	4	244	48.80
Total milk and its products used on farms.....			\$5,741.94			\$5,556.06			\$3,276.01
Milk products sold:									
Butter.....	2	218	\$64.69				5	797	\$248.07
Cream.....	1	200	30.00						
Total milk products sold.....			\$94.69						\$248.07

TABLE 72. MANURE RECOVERED AND MISCELLANEOUS RETURNS

	Less than 33 per cent of milk sold during May, June, and July		From 33 to 40 per cent of milk sold during May, June, and July		More than 40 per cent of milk sold during May, June, and July	
	Number of tons	Value	Number of tons	Value	Number of tons	Value
Manure recovered.....	6,527	\$8,158.52	5,764	\$7,204.52	3,626	\$4,533.60
Miscellaneous returns:						
Boarding cows.....		28.00				24.00
Hauling milk.....				84.00		73.00

TABLE 73. COSTS AND RETURNS FOR COWS BY SEASONAL GROUPS

	Less than 33 per cent of milk sold during May, June, and July		From 33 to 40 per cent of milk sold during May, June, and July		More than 40 per cent of milk sold during May, June, and July	
	Total value	Value per cow	Total value	Value per cow	Total value	Value per cow
Costs:						
Grain, summer.....	\$ 1,442.00	\$ 1.81	\$ 1,545.00	\$ 2.04	\$ 1,038.00	\$ 2.06
Grain, winter.....	17,977.00	22.53	13,268.00	17.53	7,588.00	15.09
Succulent feed.....	12,261.00	15.36	7,962.00	10.52	2,289.00	4.55
Dry forage.....	16,549.00	20.74	14,191.00	18.74	9,982.00	19.84
Total feed.....		\$ 60.44		\$ 48.83		\$41.54
Pasture.....	\$ 3,665.00	\$ 4.59	\$ 3,353.00	\$ 4.43	\$ 2,320.00	\$ 4.61
Bedding.....	599.00	0.75	689.00	0.91	385.00	0.77
Human labor.....	21,086.20	26.43	16,724.70	22.09	11,597.10	23.05
Horse labor.....	789.00	0.99	543.15	0.72	359.70	0.72
Hauling milk.....	6,977.75	8.75	7,420.28	9.80	5,286.76	10.51
Use of buildings.....	3,915.77	4.91	3,142.71	4.15	1,647.21	3.27
Use of equipment.....	414.75	0.52	364.05	0.48	236.30	0.47
Interest on cows.....	2,657.85	3.33	2,374.00	3.14	1,625.55	3.23
Interest on feed and supplies.....	673.50	0.84	516.50	0.68	321.50	0.64
Depreciation on cows.....	2,146.00	2.69	2,406.00	3.18	1,170.00	2.33
Bull service.....	1,102.30	1.38	533.78	0.71	335.22	0.67
Miscellaneous.....	1,361.00	1.70	1,280.00	1.69	855.00	1.70
Total costs.....	\$93,617.12	\$117.32	\$76,313.17	\$100.81	\$47,036.34	\$93.51
Returns:						
Milk sold.....	\$74,204.29	\$ 92.99	\$59,972.55	\$ 79.22	\$37,375.38	\$74.30
Milk products sold.....	94.69	0.12			248.07	0.49
Milk and milk products used.....	5,741.94	7.20	5,556.06	7.34	3,276.01	6.51
Calves and calf hides.....	1,825.00	2.29	1,713.00	2.26	1,070.00	2.13
Manure.....	8,158.52	10.22	7,204.52	9.52	4,533.60	9.03
Miscellaneous returns.....	28.00	0.03	84.00	0.11	97.00	0.19
Total returns.....	\$90,052.44	\$112.85	\$74,530.13	\$ 98.45	\$46,600.06	\$92.65
Loss.....	\$3,564.68	\$ 4.47	\$1,783.04	\$ 2.36	\$436.28	\$ 0.86

TABLE 74. RELATION OF SEASON OF PRODUCTION TO COST OF PRODUCTION AND AVERAGE PRICE OF PRODUCT

	Less than 33 per cent of milk sold during May, June, and July		From 33 to 40 per cent of milk sold during May, June, and July		More than 40 per cent of milk sold during May, June, and July	
	Herd cost	Cow cost	Herd cost	Cow cost	Herd cost	Cow cost
Cost per hundred pounds of milk sold.....	\$1.84	\$1.81	\$1.65	\$1.65	\$1.54	\$1.56
Per cent of cost (first group taken as 100).....	100	100	90	91	84	86
Cost per pound of butterfat in milk sold.....	\$0.460	\$0.452	\$0.412	\$0.412	\$0.376	\$0.380
Amount received per hundred pounds of milk sold.....	\$1.72		\$1.60		\$1.54	

Summer and winter seasons in winter dairies

In dairies producing about equal amounts of milk in summer and in winter, the cost of milk in winter was double the cost in summer. Manure and calves in winter offset all costs except for feed, for hauling milk, and for human labor. The data are given in table 75.

Conclusions regarding season of production

While the results of this study indicate that at the prices for milk, feed, labor, and other things used in milk production, the herds producing a

larger proportion of milk in summer were slightly more profitable than the winter herds, it must be remembered that changes in winter prices for milk or feed might change these relationships. For this reason it is not to be understood that in other regions, or even at times of different prices in this region, the more extensive systems of dairying are the more profitable.

TABLE 75. COSTS AND RETURNS (EXCEPT MILK) FOR PASTURE AND WINTER PERIODS, 56 FARMS, 798 COWS, WINTER DAIRIES

	Less than 33 per cent of milk sold during May, June, and July			
	Pasture period		Winter period	
	Total	Per 100 pounds of milk	Total	Per 100 pounds of milk
Costs:*				
Grain.....	\$1,442.00	\$0.081	\$17,977.00	\$0.628
Silage.....	294.00	0.016	10,865.00	0.380
Other succulent feed.....	586.00	0.033	516.00	0.018
Dry forage.....	35.00	0.002	16,514.00	0.577
Pasture.....	3,665.00	0.205		
Total feed.....	\$6,022.00	\$0.337	\$45,872.00	\$1.603
Bedding.....			599.00	0.021
Human labor.....	6,550.10	0.367	14,536.10	0.508
Horse labor.....			789.00	0.028
Hauling milk.....	2,679.59	0.150	4,298.16	0.150
Use of buildings.....	1,695.05	0.095	2,220.72	0.078
Use of equipment.....	179.54	0.010	235.21	0.008
Interest on cows.....	1,150.52	0.064	1,507.33	0.053
Interest on feed and supplies.....			673.50	0.023
Bull service.....	477.16	0.028	625.14	0.022
Depreciation on cows.....	928.96	0.052	1,217.04	0.042
Ice, and sawdust for ice.....	636.00	0.036		
Ply protectors.....	84.00	0.005		
Other miscellaneous costs.....	277.47	0.015	363.53	0.013
Total costs.....	\$20,680.39	\$1.159	\$72,936.73	\$2.549
Returns, except milk:				
Calves and calf hides.....	\$790.00	\$0.044	\$1,035.00	
Manure.....			8,158.52	
Boarding cows.....			28.00	
Total returns, except milk.....	\$790.00	\$0.044	\$9,221.52	\$0.322
Difference (= cost of milk produced).....	\$19,890.39	\$1.115	\$63,715.21	\$2.227

* The costs for hauling milk were divided according to the amount of milk produced in the pasture and in the winter period; all other costs were divided according to the length of the period — 158 days pasture, 07 days winter.

Another factor to be considered is that the aim of a well-organized farm business should be to furnish productive work thruout the year. From the farm-management point of view, the dairy enterprise must be considered in its relation to the farm business as a whole. Presumably, on many farms where dairying is the leading part of the business, the more extensive system does not furnish full employment, especially during the winter season. Such a system might pay good wages for the hours employed, while an intensive system, altho paying less by the hour, might provide a fuller year's work, and hence a larger total income.

Feeds and feeding

Details concerning the kinds, the total amounts, and the costs of various feeds used by cows, per cow and per unit of product, have already been given.

Nutrient and energy

Many careful investigations concerning the nutrient requirements of dairy cows for milk production have been carried on with single animals or with experiment-station herds. These studies have helped to establish useful standards and guides for the feeding of dairy cattle, and for this reason have been of economic value to farmers. The records obtained in the present investigation offered an opportunity to study the dry matter digestible nutrients, digestible crude protein, digestible carbohydrates, feed units, and net energy used under farm conditions, in relation to the requirements for maintenance and milk production set by the various feeding standards, and also to note the effect of various factors such as season of milk production and composition of the ration on the nutrient or the energy used per unit of product.

Certain terms are defined in more than one way in literature on feeding and therefore the following definitions are given in order to insure better understanding of the discussion.

The sum of the digestible crude protein, the digestible carbohydrates, and 2.25 times the digestible fat, is called the *total digestible nutrient*. The term *total nutrient* is often used to mean total digestible nutrient.

A *feed unit* is that amount of any feed which, when consumed by an animal, will produce the same amount of milk, flesh, or energy that is produced by a pound of corn.

The energy of feed is expended by the dairy cow in muscular activity, maintenance, growth, and milk production. The production value of feeding stuff, therefore, depends very largely on the amount of energy it will yield. A convenient unit for measuring this energy is the *therm*, which is 1000 Calories, or the amount of heat required to raise 1000 kilograms of water one degree centigrade.

Not all of the energy in a feed is available for use by the animal. Some of it is lost in the undigested parts of the feed. Some of it is lost in the combustible gases arising from fermentations in the intestines and the paunch. Some of it passes out in the urea. The fuel value of any feed which remains after deducting these three losses represents the available energy, or *metabolizable energy*, of the feed. It is that part of the energy in the feedstuff which the animal can use for body or production purposes.

But much of the available, or metabolizable, energy is spent in the work of mastication, digestion, and assimilation. That part which remains after deducting the amount used in these ways is termed the *net energy* of the feed. This is the part of the energy available for body maintenance

and for production. All energy computations in this bulletin are on the net energy basis.

Method of computing nutriment and energy.— The feeds used were divided into four classes: (1) grain, which included all concentrated feeding stuffs whether home-grown or purchased; (2) silage; (3) other succulent feed, which included feeds with a very high percentage of water; and (4) dry forage, which included hay, corn stover, and other cured roughage.

The nutrients in most of the feeds used were computed from tables in *Feeds and Feeding* (fifteenth edition), by Henry and Morrison. The digestible composition of feeds not given in these tables was calculated by applying digestion coefficients there given to analysis figures reported in Bulletin 3, Control Series, of the Massachusetts Agricultural Experiment Station. When the digestion coefficient for a particular feed was not given, the coefficient for a feed similar in character was used.

The feed-unit values assigned the different feeds were taken from Research Bulletin 26 of the Wisconsin Agricultural Experiment Station, and from *Feeds and Feeding* as already cited.

The therms in the feeds were calculated from net energy values in Bulletin 142 of the Pennsylvania Agricultural Experiment Station, or from net energy values computed by use of the formula given on pages 8 and 9 of that bulletin.

Feed, nutriment, and energy used per cow per day, supplementary to pasture.— In table 76 are given the average daily amounts of feed used supplementary to pasture, and the nutriment and net energy contained in the feed. The usual practice on these farms was to feed some grain and green corn or other succulent feed late in summer, when pastures dried up. In only ten cases, however, was silage used for this purpose. As a rule, summer production is made chiefly on grass. The therms in the feed used supplementary to pasture were equivalent to about 13 days of winter feeding. On this basis, pasture furnished 146 days, or nearly five months, of full feed for cows. This is less than on the dry-matter basis. The average nutritive ratio of feeds used with pasture was 1:5.1.

Feed, nutriment, and energy used per cow per day during the winter period.— On the average, 6.007 pounds of grain, 18.110 pounds of silage, 1.471 pounds of other succulent feed, and 20.141 pounds of dry forage, were used per cow per day in winter. This ration contained 26.912 pounds of dry matter, 16.446 pounds of digestible nutrients, 2.034 pounds of crude protein, and 13.166 pounds of digestible carbohydrates, with an energy value of 14.551 therms and representing 16.810 feed units. The average nutritive ratio was 1:7.1. Grain furnished 29.7 per cent, succulent feed 5.9 per cent, and dry forage 54.4 per cent, of the net energy value of the ration. (Table 77).

The summer dairies fed less in winter than did the winter dairies. The difference was about four pounds of digestible nutrients, or 3.8 therms,

TABLE 76. AVERAGE AMOUNTS OF FEED USED PER COW PER DAY, SUPPLEMENTARY TO PASTURE, 159 DAYS, 2058 COWS

	Pounds of feed	Dry matter		Digestible nutrients		Digestible crude protein		Digestible carbohydrates		Feed units		Net energy		Cost *
		Pounds	Per cent	Pounds	Per cent	Pounds	Per cent	Pounds	Per cent	Number of units	Per cent	Therms	Per cent	
Grain.....	0.856	0.779	46.0	0.634	51.5	0.152	75.6	0.399	43.8	0.874	62.7	0.602	51.1	\$0.0123
Stilage.....	0.471	0.099	5.8	0.063	5.1	0.005	2.5	0.054	5.9	0.078	5.6	0.056	4.8	0.0012
Other succulent feed.....	3.359	0.744	43.9	0.495	40.2	0.041	20.4	0.424	46.6	0.413	29.6	0.489	41.5	0.0049
Dry forage.....	0.084	0.072	4.3	0.040	3.2	0.003	1.5	0.034	3.7	0.030	2.1	0.031	2.6	0.0003
Total.....	4.770	1.694	100.0	1.232	100.0	0.201	100.0	0.911	100.0	1.395	100.0	1.178	100.0	\$0.0187

1.232 (pounds digestible nutrients) - 0.201 (pounds crude protein) = 1.031.

1.031 ÷ 0.201 = 5.1.

Nutritive ratio, 1:5.1.

* Omitting condimental feed and salt.

TABLE 77. AVERAGE AMOUNTS OF FEED USED PER COW PER DAY IN THE WINTER PERIOD, 206 DAYS, 2058 COWS

	Pounds of feed	Dry matter		Digestible nutrients		Digestible crude protein		Digestible carbohydrates		Feed units		Net energy		Nutritive ratio	Cost *
		Pounds	Per cent	Pounds	Per cent	Pounds	Per cent	Pounds	Per cent	Number of units	Per cent	Therms	Per cent		
Grain.....	6.007	5.442	20.2	4.447	27.1	1.050	51.6	2.825	21.5	6.177	36.8	4.319	29.7	1:3.2	\$0.0900
Stilage.....	18.110	3.813	14.2	2.414	14.7	0.182	9.0	2.068	15.7	3.015	17.9	2.164	14.9	1:12.3	0.0452
Other succulent feed.....	1.471	0.204	0.8	0.154	0.9	0.018	0.9	0.131	1.0	0.155	0.9	0.146	1.0	0.0032	0.0032
Dry forage.....	20.141	17.453	64.8	9.431	57.3	0.784	38.5	8.142	61.8	7.463	44.4	7.922	54.4	1:7.6	0.0958
Total.....	45.729	26.912	100.0	16.446	100.0	2.034	100.0	13.166	100.0	16.810	100.0	14.551	100.0	1:7.1	\$0.2342

16.446 (pounds digestible nutrients) - 2.034 (pounds crude protein) = 14.412.

14.412 ÷ 2.034 = 7.1.

Nutritive ratio, 1:7.1.

* Omitting condimental feed and salt.

TABLE 78. RELATION OF SEASON OF MILK PRODUCTION TO AVERAGE AMOUNTS OF FEED USED PER COW PER DAY IN THE WINTER PERIOD

	Pounds	Dry matter (pounds)	Digestible nutrients		Digestible crude protein		Digestible carbohydrates (pounds)	Feed units	Net energy		Cost*	Nutritive ratio
			Pounds	Per cent	Pounds	Per cent			Therms	Per cent		
Less than 33 per cent of milk sold during May, June, and July, 56 farms, 798 cows, 207 days												
Grain.....	7.222	6.554	5.336	28.6	1.317	54.0	3.204	7.469	5.188	31.3	\$0.1073	1:3.05
Silage.....	26.306	5.524	3.499	18.7	0.263	10.8	2.999	4.380	3.144	18.9	0.0658	1:12.3
Other succulent feed.....	1.766	0.233	0.174	0.9	0.023	1.0	0.145	0.175	0.164	1.0	0.0031	1:6.6
Dry forage.....	20.536	17.820	9.663	51.8	—	0.835	34.2	8.301	7.689	48.8	0.1000	1:10.6
Total.....	55.830	30.131	18.672	100.0	2.438	100.0	14.739	19.713	16.587	100.0	\$0.2762	1:6.7
From 33 to 40 per cent of milk sold during May, June, and July, 52 farms, 757 cows, 205 days												
Grain.....	5.568	5.036	4.120	26.8	0.937	50.7	2.674	5.694	4.003	29.4	\$0.0836	1:3.40
Silage.....	17.365	3.694	2.323	15.1	0.175	9.5	1.990	2.891	2.075	15.2	0.0432	1:12.3
Other succulent feed.....	1.068	0.177	0.137	0.9	0.015	0.8	0.117	0.143	0.127	0.9	0.0034	1:8.1
Dry forage.....	18.821	16.301	8.784	57.2	0.722	39.0	7.595	6.952	7.459	54.5	0.0911	1:11.2
Total.....	43.187	25.188	15.364	100.0	1.849	100.0	12.376	15.680	13.634	100.0	\$0.2213	1:7.3
More than 40 per cent of milk sold during May, June, and July, 41 farms, 503 cows, 204 days												
Grain.....	4.773	4.318	3.554	24.3	0.803	47.8	2.326	4.886	3.437	26.8	\$0.0727	1:3.43
Silage.....	6.215	1.395	0.827	5.6	0.062	3.7	0.708	1.035	0.743	5.8	0.0155	1:12.3
Other succulent feed.....	1.068	0.108	0.148	1.0	0.014	0.8	0.128	0.140	0.148	1.2	0.0032	1:9.6
Dry forage.....	21.689	18.766	10.125	69.1	0.803	47.7	8.791	7.942	8.471	66.2	0.0971	1:11.6
Total.....	33.745	24.587	14.654	100.0	1.682	100.0	11.953	14.003	12.799	100.0	\$0.1885	1:7.7

* Omitting condimental feed and salt.

per cow per day. Also, less silage and a poorer quality of roughage were used in summer dairies, and the ration was wider, being 1:7.7 in summer dairies and 1:6.7 in winter dairies. In the summer dairies, grain furnished 27 per cent of the energy. On farms where more winter milk was made, grain furnished more of the energy, and roughage, especially dry forage, furnished less. This, together with less silage and poorer hay, accounts for the difference in nutritive ratio. (Table 78.)

Rations compared with feeding standards.—The average weight of the cows was not ascertained, but in order to make comparisons with feeding standards it was assumed to be 1000 pounds. The average daily production in the winter period of 206 days from October 9 to May 14 for the 2058 cows was 14.037 pounds of 4-per-cent milk. In the pasture period it was 16.609 pounds of 4-per-cent milk.

It would not be expected that the feed used by the cows on these farms would check exactly with requirements according to feeding standards for 1000-pound cows with this production, for the following reasons:

1. Probably feeding standards have been determined with higher producers and possibly more efficient users of feed than the cows in question.
2. Probably feeding standards have been based on fresh cows or cows near the beginning of their lactation. On the other hand, many of the cows in question were finishing their lactation during winter. More nutriment is required for production at the end of a lactation period than at the beginning.
3. Probably the roughage used on these farms was of poorer quality than that on which standards are based. Also some of this was waste from the mangers used as bedding, and for this there has been no deduction from the dry forage.
4. It is likely that feeding standards have been arrived at with rations carrying a larger proportion of concentrates, and especially succulent feed, than the rations here used.
5. It is possible that the nutrient and energy values applied to the feeds used, particularly to the roughages, may have exceeded their actual values.
6. Probably animals used in feeding-standard experiments were more nearly of the age of maximum production efficiency and in better average condition than the herds studied. Of the 2058 cows included, some were heifers with the first calf, some were old cows, some were animals out of condition because of calving difficulties, and some were cows that had failed to breed. In choosing cows for feeding trials, probably such cows are eliminated, but dairymen are always confronted with the problem of carrying a considerable proportion of such animals.
7. One would presume that the feeding, watering, care, and stabling conditions of animals on experimental trials would favor more efficient use of feeds than is practicable on the ordinary farm.
8. There is a possibility that the assumed weight of the cows may have been less than their actual weight.

TABLE 79. RATIONS COMPARED WITH THE DAILY REQUIREMENTS FOR MAINTENANCE AND MILK PRODUCTION ACCORDING TO VARIOUS FEEDING STANDARDS, 2058 COWS

	Feed units, Hanson	Dry matter (in pounds), Woll- Humphrey	Digestible nutrients (in pounds)				Digestible crude protein (in pounds)				Net energy (in therms)		
			Modified Woll- Lehmann	Haecker	Woll- Humphrey	Savage	Hanson	Modified Woll- Lehmann	Haecker	Woll- Humphrey	Savage	Armshy	Eckles
Maintenance, 1000-pound cow.....	6.6	12.5	7.925	7.925	7.900	7.925	0.650	0.700	0.700	0.700	0.700	6.000	6.000
Pasture period:													
Production (16,609 pounds of 4-per- cent milk).....	5.5	18.7	5.747	5.697	12.300	5.813	0.789	0.988	0.897	1.490	1.080	4.484	4.983
Total required.....	12.1	31.2	13.672	13.622	20.200	13.738	1.439	1.688	1.597	2.190	1.780	10.484	10.983
Amount in supplementary feed.....	1.4	1.7	1.232	1.232	1.232	1.232	0.201	0.201	0.201	0.201	0.201	1.178	1.178
Amount furnished by pasture on standard basis.....	10.7	29.5	12.440	12.390	18.968	12.506	1.238	1.487	1.396	1.989	1.579	9.306	9.805
Winter period:													
Production (14,037 pounds of 4-per- cent milk).....	4.6	18.7	4.857	4.815	12.300	4.913	0.667	0.835	0.758	1.490	0.912	3.790	4.211
Total required.....	11.2	31.2	12.782	12.740	20.200	12.838	1.317	1.535	1.458	2.190	1.612	9.790	10.211
Total used.....	16.8	26.9	16.446	16.446	16.446	16.446	2.034	2.034	2.034	2.034	2.034	14.551	14.551
Amount used in excess of (or below) standard.....	5.6	-4.3	3.664	3.706	-3.754	3.608	0.717	0.499	0.576	-0.156	-0.422	4.761	4.340
Per cent of deviation from standard.....	+50.0	-13.8	+28.7	+29.1	-18.6	+28.1	+54.4	+32.5	+39.5	-7.1	+26.2	+32.7	+29.8

The actuality of any one or all of these suppositions would make what appears in table 79 to be an excess over standard requirements from one-fourth to one-third, really too high. It is probable that if proper allowance could be made for all of these points, the nutriment and net energy used would check very closely with the standards, all of which, of those proposed lately, agree very closely.

Nutriments and energy used per unit of product.—For each hundred pounds of milk produced in winter there were contained, in the winter feed, 191.72 pounds of dry matter, 117.17 pounds of digestible nutrients, 14.49 pounds of digestible crude protein, and 93.8 pounds of digestible carbohydrates. This feed represented 119.76 feed units and contained 103.67 therms of energy (Table 80). Since the milk tested 4 per cent, one-fourth of these respective quantities was used per pound of butterfat.

TABLE 80. NUTRIMENT, EXCEPT PASTURE, USED PER UNIT OF PRODUCT

	Per 100 pounds of milk produced			Per pound of butterfat produced		
	Pasture period (excluding pasture)	Winter period	Year	Pasture period (excluding pasture)	Winter period	Year
Less than 33 per cent of milk sold during May, June, and July, 56 farms, 798 cows						
Dry matter (pounds).....	12.32	173.93	111.87	3.08	43.44	27.94
Digestible nutrients (pounds).....	8.81	107.78	69.78	2.20	26.92	17.43
Digestible crude protein (pounds).....	1.48	14.07	9.24	0.37	3.51	2.31
Digestible carbohydrates (pounds).....	6.40	85.08	57.02	1.60	21.25	13.71
Feed units.....	10.23	113.80	74.02	2.56	28.42	18.49
Therms.....	8.25	95.75	62.16	2.06	23.91	15.53
From 33 to 40 per cent of milk sold during May, June, and July, 52 farms, 757 cows						
Dry matter (pounds).....	10.18	193.02	100.56	2.54	48.25	25.14
Digestible nutrients (pounds).....	7.40	117.74	61.94	1.85	29.43	15.41
Digestible crude protein (pounds).....	1.22	14.17	7.62	0.31	3.54	1.91
Digestible carbohydrates (pounds).....	5.50	94.85	49.66	1.38	23.71	12.41
Feed units.....	8.24	120.16	63.56	2.06	30.04	15.89
Therms.....	7.19	104.48	55.28	1.80	26.11	13.82
More than 40 per cent of milk sold during May, June, and July, 41 farms, 503 cows						
Dry matter (pounds).....	7.82	237.07	100.12	1.92	58.46	24.64
Digestible nutrients (pounds).....	5.88	141.30	60.40	1.45	34.84	14.86
Digestible crude protein (pounds).....	0.88	16.21	7.05	0.22	4.00	1.74
Digestible carbohydrates (pounds).....	4.43	115.25	49.05	1.09	28.42	12.07
Feed units.....	6.56	135.02	58.28	1.61	33.29	14.34
Therms.....	5.65	123.41	53.07	1.39	30.43	13.66
All herds						
Dry matter (pounds).....	10.20	191.72	105.07	2.54	47.79	26.16
Digestible nutrients (pounds).....	7.42	117.17	64.78	1.85	29.20	16.13
Digestible crude protein (pounds).....	1.21	14.49	8.15	0.30	3.61	2.03
Digestible carbohydrates (pounds).....	5.48	93.80	51.64	1.36	23.37	12.86
Feed units.....	8.40	119.76	66.61	2.09	29.85	16.50
Therms.....	7.09	103.67	57.57	1.76	25.84	14.33

In winter dairies, more of the cows freshen in the fall and are at the beginning of their lactation during winter. Thus they make more efficient use of barn feed than do cows in summer dairies, requiring very much less nutriment or energy per unit of product in winter. But the summer dairies get such a large proportion of their production on grass, that when the total year's product is divided into the barn feed, the nutriment and energy factors are less than for winter dairies. From this it is apparent that in studying the relation of any variation in feeding practice to production, nutriment or energy used per unit of product, cost of production, or profits, this factor of season of production must first be considered.

Production in the 159 pasture days was 2641 pounds per cow. Assuming that the energy requirements for maintenance and production during the pasture period are the same as in winter, the pasture production would require 2738 therms per cow. Of this, 187 therms were furnished by supplementary feed, leaving 2550 therms furnished by pasture. This is 16.040 therms per cow per day, or about one therm per pound of milk produced. This averages 5.174 therms per cow per day for each acre pastured. The data are given in table 81:

TABLE 81. NUTRIMENT AND ENERGY FURNISHED BY PASTURE ON BASIS OF NUTRIMENT AND ENERGY IN WINTER FEED PER UNIT OF PRODUCT

	Digestible nutrients (pounds)	Digestible crude protein (pounds)	Digestible carbo- hydrates (pounds)	Feed units	Therms
Per 1000-pound cow per day.....	18.228	2.206	14.668	18.496	16.040
Per cow per acre per day.....	5.88	0.712	4.732	5.966	5.174

In addition to the requirements for maintenance according to Savage's standard, there were used 60.71 pounds of total digestible nutrients, containing 9.5 pounds of digestible crude protein, for each hundred pounds of milk produced in the winter period (table 82). The energy furnished amounted to 60.92 therms per hundred pounds of milk produced in winter,

TABLE 82. NUTRIMENT USED BY 2058 COWS, LESS REQUIREMENTS FOR MAINTENANCE, WINTER PERIOD *

	Per hundred pounds of milk produced	Per pound of butterfat produced
Digestible nutrients (pounds).....	60.71	15.13
Digestible crude protein (pounds).....	9.50	2.37
Net energy (therms).....	60.92	15.18

* The maintenance deducted in calculating the digestible nutrients and crude protein is the standard given by Savage, and the maintenance deducted in calculating net energy is the standard given by Armsby.

in addition to maintenance requirements. Under these circumstances pound of digestible nutrients, on the average, had a value for milk production purposes equal to a therm of energy. There is, of course, variation with different feeds in their relative nutriment and net energy values.

Proportion of nutriment and energy used in winter period returned in milk—Considering that 100 pounds of 4-per-cent milk contains 17.9 pounds of digestible nutrients, 3.3 pounds of digestible protein, and 29.01 therms then 15.3 per cent of the digestible nutrients, 22.8 per cent of the digestible crude protein, and 28 per cent of the net energy in the winter feed, were contained in the milk produced in winter.

Use of concentrates

Dairymen on these farms are using chiefly high-grade concentrated feeds. The percentage that each feed represents of the total pounds of concentrates used by cows, excluding salt and condimental feeds, is given in table 1 (page 280). Gluten made up 38 per cent, and wheat by-product 21 per cent, making 59 per cent of the total. Molasses feeds comprised only 9 per cent, and other mixed feeds, except distillers' grains, only 1 per cent, of the total.

Of the total concentrates used by cows, 44 per cent were by-products derived largely from corn, 21 per cent were by-products from wheat, and 26 per cent were by-products from other sources, some containing both corn and wheat by-products, making a total of 91 per cent of by-products. Of the total, 82 per cent were unmixed feeds. Altho in general the price per ton is lower, the cost of energy or nutriment in molasses feeds is higher than in such feeds as gluten, distillers' grains, and cottonseed meal. There is considerable variation in the cost of nutriment in standard feeds. This matter deserves careful consideration in planning rations. From the standpoint of the cost of energy, cornmeal, cottonseed meal, gluten, and distillers' grains, and several other high-protein feeds, are the more economical. On the basis of the energy contained, wheat feed and wheat bran are frequently expensive feeds, but from the standpoint of the physiological effect on the animal it is often advisable to purchase them even at greater cost.

It was urged as a war measure that New York farmers should raise more grain for cow feed. But cereals have a small protein content, and the dairy farmer wants a high-protein by-product feed to use with corn silage and mixed hay, rather than a low-protein home-grown grain. It might be desirable to raise the grain; but if one raises grain fit for human food he will often benefit not only himself but also the public by selling it and buying high-protein by-products for his dairy.

Proportion of energy of winter ration in grain.—After being grouped according to season of milk production, the records were subsorted into groups

according to the percentage of the therms in the winter ration that came from grain. As shown by the figures in table 83, the larger the proportion of energy in the winter ration from grain, the higher is the production, especially in the summer dairies. This is in spite of the fact that a large proportion of the grain in the ration was accompanied by lighter total feeding, particularly in the winter dairies. Farmers with good cows may feed more grain relatively than those with poor cows, but it is never possible to tell how much of the high yield is due to the cow and how much to the extra grain. The common practice is to allow cows as much roughage as they will eat clean, and grain according to its price and to the price of milk. When milk is relatively high, more grain is usually fed and the proportion of grain to roughage then changes. The cost of milk production is much less and the profit per cow higher when a large proportion of the energy in the winter ration comes from grain. Also, more milk is produced to each dollar of feed cost. Since, however, the nutritive ratio of grain is narrow, a relatively large proportion of grain in a ration means relatively more protein. It is possible that much of the effect of the rations with more grain may have been due to the more liberal supply of protein.

It is of importance to watch the condition of a cow as she advances in lactation, in order to tell whether or not a sufficient quantity of the right kind of grain is being given. Sometimes it happens that good producers are allowed to lose too much body weight or to shrink in milk flow, because it is not realized how much nutriment their production requires. A relatively heavy allowance of grain and less roughage reduces the bulk of the ration. Inasmuch as a cow's capacity for handling feed is limited among other things by the bulk of the ration, it becomes necessary to furnish large quantities of concentrates to increase the proportion of energy to bulk, the amount depending on the character of the roughage. The more grain used, the more essential it is that it should include a variety of feeds.

The extent to which additional amounts of grain fed in winter increase the milk flow depends much on the time of calving. A spring-fresh cow will not respond in yield to winter grain as will a fall-fresh cow, and cannot profitably use so much grain as one that is at the beginning of the lactation period during winter. Largely for this reason, less grain is used during the winter in summer dairies. When all the cows freshen in the spring very little grain is used.

Heavier grain feeding not only increases the cost of feed, but also increases the other costs. More milk means more labor, and higher interest and depreciation costs on the cow.

Selecting the lightest grain feeders tends to select the most extensive dairies. These herds produce more milk per pound of grain, because more of it is produced on cheap feed. As more winter feed is used, less milk per pound of feed or per dollar of cost is obtained.

TABLE 83. PROPORTION OF ENERGY IN THE WINTER RATION IN GRAIN RELATED TO PRODUCTION, COST OF PRODUCTION, AND PROFITS

Per cent of milk sold during May, June, and July	Per cent of therms of winter ration in grain	Number of farms	Number of cows	Pounds of milk produced per cow			Cow cost of milk sold per 100 pounds	Profit or loss per cow	Value of feed except pasture, per cow	Pounds of milk produced to each dollar's worth of feed except pasture	
				Total for year	October to April inclusive	May to September inclusive				Total for year	Winter only
Less than 33	Under 25	13	165.5	5,543	3,414	2,129	\$2.06	-\$17	\$67	82	51
	25-37...	27	367.5	5,850	3,593	2,347	1.78	- 3	59	99	59
	Over 37...	16	265.0	5,957	3,563	2,394	1.70	+ 1	58	103	61
From 33 to 40	Under 25	13	217.0	5,017	2,366	2,651	\$1.87	-\$12	\$50	100	47
	25-37...	28	417.5	5,568	2,664	2,904	1.60	0	49	113	54
	Over 37...	11	122.5	5,580	2,601	2,979	1.45	+ 8	45	125	58
More than 40	Under 25	18	214.0	5,124	1,022	3,202	\$1.67	-\$ 6	\$43	120	45
	25-33...	14	171.5	5,993	1,959	3,134	1.50	+ 2	38	134	52
	Over 33...	9	117.5	5,730	2,239	3,491	1.45	+ 4	45	128	50

Proportion of energy of grain in winter ration from feeds containing more than 25 per cent of protein.—The principal forage crops grown on these farms are low in protein. This tends to make a wide ration. To supply this deficiency of protein in the roughage it is very important that the concentrates used should be high-protein feeds. This fact is not yet fully appreciated by all dairymen. If corn silage with well-matured ears is used, the proportion of high-protein grains may be increased with good results. High-protein feeds make better manure. It is an unusual practice to feed nothing but concentrates containing more than 25 per cent of protein, but when the silage contains plenty of grain this is sometimes found desirable. Production is better, cost of production is less, and the profit per cow is higher, the larger the proportion of the therms of the winter grain carried in feeds containing more than 25 per cent of protein, regardless of the season of milk production.

With the summer dairies an increase from 5 to 86 per cent of the energy in the winter grain coming from high-protein feeds was accompanied by a decrease in the cost of milk from \$1.75 to \$1.35 a hundred pounds, and a change in profit from a loss of \$11 a cow to a gain of \$10 a cow. With winter dairies an increase from 32 to 82 per cent of the energy coming from high-protein feeds was accompanied by a decrease in the cost of milk from \$1.96 to \$1.58 a hundred pounds, and a change in profit from a loss of \$14 a cow to a gain of \$10 a cow. It is likely that the farms using the high-protein concentrates also had roughage containing more protein, and perhaps better cows. Possibly these results cannot be attributed altogether to the difference in protein content of the grain part of the ration, altho it is safe to believe that most of the difference is due to a liberal supply of protein.

More than one-fourth of the solids of milk are protein. Protein furnishes much of the energy of the animal's needs, and also factors largely in the growth of the fetus. Therefore it is important to furnish sufficient protein. In some herds not enough protein is supplied for the most economical production. The cost per unit of energy or nutriment should be the guide in making the choice of feeds, not the cost per ton. In some instances low-protein feeds are chosen because they are erroneously supposed to be cheaper. Another factor that discourages the use of high-protein by-products is the fear of udder trouble or other injury to the cow. Some farmers will use no gluten, and others will use no cottonseed meal, because they fear the use of these feeds will cause garget or other udder troubles or will wear the cow out too quickly. As a matter of fact, more care must be exercised in the use of these two feeds than with any others commonly fed to dairy cows. Especially is this true if there is little or no succulent feed used. The supply of distillers' and brewers' grains is being cut off. But there is some cottonseed meal now being used for fertilizer that might be fed to cattle. Quantities of linseed cake, which was formerly exported,

may be used for stock feeding. Coconut meal, peanut meal, and other high-protein feeds are coming on the market in small amounts. But the chief sources of protein which at present are not most fully used are cottonseed meal and oilmeal. Many dairymen might find it profitable to use a larger proportion of these feeds, especially oilmeal.

A better way of studying the effect of protein supply would have been to sort the records by the percentage of protein in the grain. This would have involved many more calculations, but it would have given a more specific idea of how much protein the grain should contain.

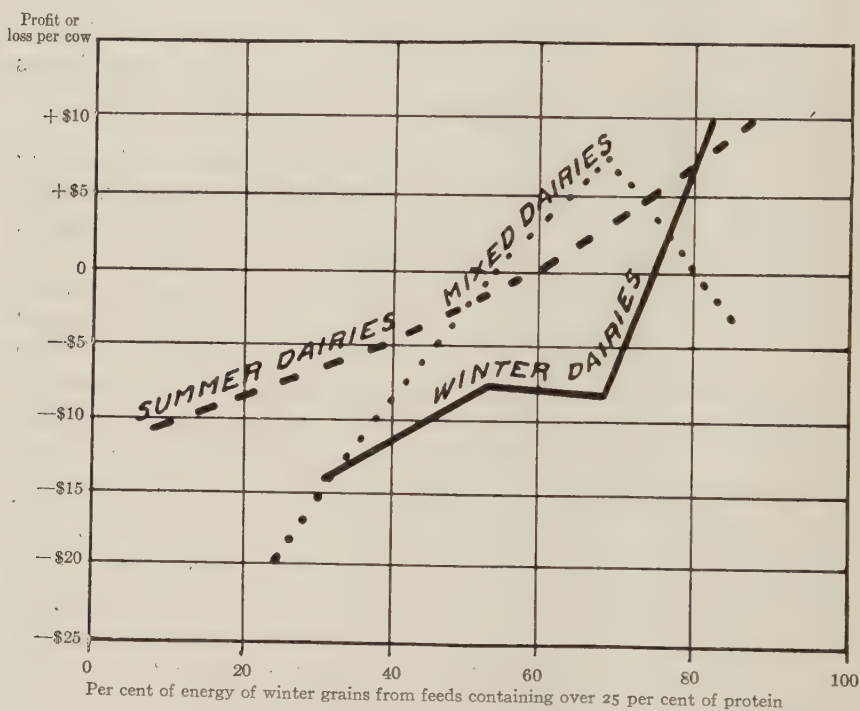


FIG. 61. INCREASED PROFIT RESULTING FROM LIBERAL USE OF HIGH-PROTEIN CONCENTRATES

The high prices of concentrates have led to recommendations that dairy farmers grow more grain for cows on their own farms, and depend less than in the past on purchased by-products. On most dairy farms this would mean keeping less cows, or replacing some cash crops — often a crop that could be used directly for human food — with corn for grain, oats, barley, or buckwheat, to be used as cattle feed, and thus decreasing the size of the business. Also, it would mean providing largely carbohydrate material rather than protein, all of which is undesirable.

Another way of getting more protein into the ration is by the use of leguminous roughages. Unfortunately, in most regions where dairying

TABLE 84. PROPORTION OF ENERGY OF GRAIN IN WINTER RATION FROM FEEDS CONTAINING MORE THAN 25 PER CENT OF PROTEIN, AS RELATED TO PRODUCTION, COST OF PRODUCTION, AND PROFITS

Per cent of milk sold during May, June, and July	Per cent of therms in grains from feeds containing more than 25 per cent of protein	Num-ber of farms	Num-ber of cows	Therms per cow			Per cent of therms in grains containing more than 25 per cent of protein	Num-ber of cows per farm	Pounds of milk produced per cow			Cow cost of milk per 100 pounds	Profit or loss per cow	Value of feed except pasture, per cow	Pounds of milk produced in winter per pound of grain
				In grains with 25 per cent or less of protein	In grains with more than 25 per cent of protein	Total winter ration			Total for year	October to April inclusive	May to September inclusive				
Less than 33	Under 40.	7	99.5	748	345	3,882	31.6	14.2	5,932	3,480	2,452	\$1.96	-\$14	\$71	2.3
	40-60	15	176.5	479	555	3,430	53.7	11.8	5,558	3,303	2,255	1.84	— 7	57	2.3
	60-75	22	339.5	365	736	3,474	66.9	15.4	5,706	3,376	2,330	1.88	— 8	61	2.1
From 33 to 40	Over 75	12	182.5	193	856	3,111	81.6	15.2	6,232	3,951	2,281	1.58	+ 10	57	2.6
	Under 40.	9	114.5	736	254	3,226	25.7	12.7	5,281	2,600	2,681	2.00	— 20	56	1.8
	40-60	18	272.0	419	412	2,694	40.6	15.1	5,383	2,585	2,798	1.63	— 2	47	2.1
More than 40	60-75	13	195.5	443	520	2,719	68.2	15.0	5,523	2,521	3,002	1.46	+ 7	46	2.3
	Over 75	12	175.0	115	642	2,751	84.8	14.6	5,419	2,518	2,901	1.67	— 3	50	2.4
	Under 25.	5	55.0	543	29	2,615	5.0	11.0	4,836	1,685	3,151	1.75	— 11	41	1.9
	25-60	20	252.5	312	312	2,502	45.4	12.6	5,215	1,996	3,219	1.62	— 4	41	2.0
	60-75	9	105.0	238	608	2,786	69.0	11.7	5,223	1,956	3,267	1.51	+ 2	45	1.9
	Over 75	7	99.5	105	668	2,531	86.4	12.9	5,659	2,304	3,355	1.35	+ 10	39	2.2

TABLE 85. RELATION OF AMOUNT OF CONCENTRATES USED, TO DIMINISHING RETURNS

Per cent of milk sold during May, June, and July	Pounds of grain fed per cow	Average pounds of grain fed per cow	Pounds of milk produced per cow	Increase in pounds of grain per cow	Increase in pounds of milk per cow	Increase in value of feed except pasture, per cow	Pounds of milk sold per dollar of additional feed cost except pasture	Value of increased amount of milk sold per dollar of additional feed cost except pasture	Increase in total returns per dollar of increased cost	Pounds of milk produced	
										Per pound of grain fed	Per dollar's worth of feed except pasture
Less than 33	Under 1200.	965	5.264	.....	.....	.....	.....	.....	.....	5.5	117
	1200-1600..	1,375	5.387	410	123	\$11	11	\$0.45	\$0.26	3.9	96
	Over 1600..	2,077	6.257	702	870	12	72	1.42	1.46	3.0	92
From 33 to 40	Under 1100.	912	5.024	.....	.....	.....	.....	.....	.....	5.5	123
	1100-1500..	1,272	5.291	300	267	9	30	0.67	0.70	4.2	106
	Over 1500..	1,741	5.895	469	604	6	101	1.50	0.89	3.4	105
More than 40	Under 1000.	830	5.042	.....	.....	.....	.....	.....	.....	6.1	136
	1000-1200..	1,082	5.045	252	3	2	2	0.00	0.25	4.7	129
	Over 1200..	1,598	5.747	516	702	11	64	1.00	0.65	3.6	115

is the leading enterprise, the soil, the length of the rotation, and other factors are not conducive to the profitable production of alfalfa. Very little alfalfa is grown in most dairy sections of New York, and relatively few dairy cows are kept where most of the alfalfa is grown. Clover hay must furnish the bulk of the leguminous dry roughage in most regions of the State where dairy cattle are kept, but on many of the farms in Broome County the supply of clover is limited. Until more leguminous roughage is grown, the grain mixture will need to contain a great deal of protein.

The relation of the proportion of energy of grain in winter rations containing more than 25 per cent of protein, to production, cost of production, and profits, is shown in table 84. The relation of the amount of concentrates used, to diminishing returns, is shown in table 85.

Use of succulent feed

Of the 69 herds fed silage, 46 produced less than 36 per cent of the milk sold during May, June, and July, and 23 produced 36 per cent or more of the milk sold during those months. Of the 80 herds not using silage, 35 came in the first group and 45 in the second. For convenience of discussion, the dairies whose herds produced less than 36 per cent of their product in these three months are here called *winter dairies*, and those producing 36 per cent or more of their product in those months are called *summer dairies*. This includes all dairies in two groups as to season, instead of three as before, necessitated by the small number of records. It offers a satisfactory index of the tendency toward more intensive dairy methods on the one hand, and more extensive methods on the other.

The herds in winter dairies using silage averaged four cows larger, and those in summer dairies using silage averaged about two cows larger, than in those not using silage.

Relation of the feeding of silage to other feed used.—In winter dairies the amount of grain fed per cow was approximately the same when silage was used as when none was used. The average amount of silage used was 7961 pounds per cow. The average quantity of dry forage was 2566 pounds less in herds using silage than in the others. Apparently about three pounds of silage was fed for each pound of dry forage replaced. Three pounds of silage cannot be grown in New York as cheaply as can one pound of hay, nor can it be grown for the usual price of one pound of hay. Silage is fed heavily in winter dairies because three pounds of it are worth more than one pound of hay. The cost of producing a unit of energy is probably less with silage than with most other kinds of succulent feed.

In summer dairies also, the amount of grain fed was about the same, regardless of whether or not silage was used. Farms using silage fed 5845 pounds of silage per cow. Farms not using silage fed 1620 pounds more of dry forage. In summer dairies it would appear that about three and one-half pounds of silage was substituted for each pound of dry forage.

When silage was fed, more milk was produced per cow. This average 661 pounds more per cow in winter dairies, but only 96 pounds more per cow in summer dairies. Feeding silage to dry cows does not materially increase production.

The figures showing these relationships are given in tables 86 to 88:

TABLE 86. RELATION OF FEEDING OF SILAGE TO FEED USED

	Less than 36 per cent of milk sold during May, June, and July		36 per cent or more of milk sold during May, June, and July		Average	
	Silage	No silage	Silage	No silage	Silage	No silage
Number of farms.....	46	35	23	45	69	80
Number of cows.....	722.5	414.5	349.0	572.0	1,071.5	986.5
Cows per farm.....	15.7	11.8	15.2	12.7	15.5	12.3
Pounds of milk produced per cow.....	5,930	5,269	5,399	5,303	5,756	5,289
Pounds of grain fed per cow.....	1,569	1,554	1,217	1,212	1,454	1,356
Pounds of silage per cow.....	7,961	.....	5,845	.....	7,272	.....
Pounds of other succulent feed per cow.....	826	863	854	891	835	880
Pounds of dry forage per cow.....	3,350	5,916	3,005	4,625	3,237	5,167
Value of feed except pasture, per cow.....	\$61	\$51	\$49	\$41	\$57	\$45

TABLE 87. RELATION OF FEEDING OF SILAGE TO AVERAGE AMOUNTS OF FEED USED PER COW PER DAY IN THE WINTER PERIOD

(36 per cent or more of milk sold during May, June, and July)

Silage, 23 farms, 349 cows, 210 days					
	Pounds of feed	Pounds of digestible nutrients	Pounds of digestible crude protein	Therms	Nutritive ratio
Grain.....	4.887	3.614	0.860	3.522	1:3.2
Silage.....	27.622	3.674	0.276	3.301	1:12.3
Other succulent feed.....	1.336	0.106	0.014	0.092	1:6.6
Dry forage.....	14.308	6.696	0.586	5.764	1:10.4
Total.....	.....	14.090	1.736	12.679	1:7.1
No silage, 45 farms, 572 cows, 203 days					
Grain.....	5.223	3.895	0.863	3.779	1:3.5
Silage.....	.....	.....	.....	.....	.....
Other succulent feed.....	0.877	0.155	0.015	0.155	1:9.3
Dry forage.....	22.729	10.620	0.831	8.880	1:11.8
Total.....	.....	14.670	1.709	12.814	1:7.6

TABLE 88. RELATION OF FEEDING OF SILAGE TO AVERAGE AMOUNTS OF FEED USED PER COW PER DAY IN THE WINTER PERIOD

(Less than 36 per cent of milk sold during May, June, and July)

Silage, 46 farms, 722.5 cows, 206 days					
	Pounds of feed	Pounds of digestible nutrients	Pounds of digestible crude protein	Therms	Nutritive ratio
Strain.....	6.736	4.976	1.217	4.828	1:3.1
Silage.....	37.984	5.066	0.381	4.539	1:12.3
Other succulent feed.....	1.967	0.197	0.023	0.179	1:7.6
Dry forage.....	16.143	7.617	0.686	6.415	1:10.1
Total.....	.....	17.856	2.307	15.961	1:6.7
No silage, 35 farms, 414.5 cows, 205 days					
Strain.....	6.813	5.035	1.187	4.888	1:3.2
Silage.....	.....	.....	.....	.....	.....
Other succulent feed.....	1.545	0.120	0.017	0.125	1:6.1
Dry forage.....	28.810	13.422	1.070	11.184	1:11.5
Total.....	.....	18.577	2.274	16.197	1:7.2

The quantities of feed used per hundred pounds of milk produced with and without silage are given in table 89:

TABLE 89. RELATION OF FEEDING OF SILAGE TO AMOUNTS OF FEED USED PER HUNDRED POUNDS OF MILK

	Less than 36 per cent of milk sold during May, June, and July		36 per cent or more of milk sold during May, June, and July		Average	
	Silage	No silage	Silage	No silage	Silage	No silage
Strain.....	26.5	29.5	22.5	22.9	25.3	25.6
Silage.....	134.2	.....	108.3	.....	126.3	.....
Other succulent feed.....	13.9	16.4	15.8	16.8	14.5	16.6
Dry forage.....	56.5	112.3	55.7	87.2	56.2	97.7

Relation of the feeding of silage to cost and returns.—In winter dairies the average cost of milk was 13 cents a hundred pounds, and the cow cost was 10 cents a hundred pounds, higher for herds not using silage. This difference is not entirely due to the lack of silage. The herds were smaller. On the other hand, when no silage was used, a larger proportion of the milk was produced in summer, which tends to lower the cost. Had silage been charged at \$7.26 a ton instead of at \$5 a ton in winter dairies using silage, they would still have paid as well as winter dairies not using silage.

For the summer dairies, however, both the herd cost and the cow cost of milk production in herds not using silage was 23 cents a hundred pound less than in herds using silage. This is in spite of the fact that the no silage herds were smaller. It would have been necessary to charge silage at \$1.92 a ton instead of at \$5 in summer dairies using silage, to have had them pay as well as summer dairies not using silage.

With the more intensive systems of dairying, silage seems to be essential for the most economical production. On the other hand, with cows that freshen in the spring good results may be obtained without its use. The economic advantages of the silo are in proportion to the size of the herd as well as to the intensity of the system. That farmers appreciate this is shown by the fact that the large herds and winter dairies more frequently have silos. Figures bearing on this relation are given in tables 90 to 93.

TABLE 90. RELATION OF FEEDING OF SILAGE TO PRODUCTION, SEASON OF PRODUCTION, COST OF PRODUCTION, AND PROFITS

	Less than 36 per cent of milk sold during May, June, and July		36 per cent or more of milk sold during May, June, and July		Average	
	Silage	No silage	Silage	No silage	Silage	No silage
Average per cent produced in May, June, and July.....	28	31	39	41	32	30
Average per cent produced in November, December, January, and February....	33	31	22	18	37	23
Herd cost of milk per hundred pounds.....	\$1.78	\$1.91	\$1.69	\$1.46	\$1.75	\$1.64
Cow cost of milk per hundred pounds.....	\$1.75	\$1.90	\$1.69	\$1.46	\$1.73	\$1.63
Amount received per hundred pounds of milk sold..	\$1.71	\$1.68	\$1.58	\$1.55	\$1.67	\$1.60
Total costs per cow.....	\$116.00	\$111.00	\$102.00	\$90.00	\$111.00	\$99.00
Total returns per cow.....	\$114.00	\$100.00	\$97.00	\$94.00	\$108.00	\$97.00
Profit or loss per cow.....	-\$2.00	-\$11.00	-\$5.00	+\$4.00	-\$3.00	-\$2.00
Receipts per cow from milk sold.....	\$94.00	\$81.00	\$77.00	\$75.00	\$89.00	\$78.00

With winter dairies, when more than 30 per cent of the energy came from succulent feed, production per cow in winter was 821 pounds more than when less than 10 per cent of the energy came from succulent feed. With summer dairies the influence of succulent feeds on production was not so marked. This again is due to the fact that with the summer system more of the cows are dry or nearly dry in winter, and hence do not respond in yield to the use of silage. When silage is not fed, turnips, mangels, cabbages, or other root crops, or laxative feed such as oilmeal and wheat bran, may be depended on to keep the cows in good condition before calv-

TABLE 91. RELATION OF SEASON OF MILK PRODUCTION AND PROPORTION OF ENERGY OF THE WINTER RATION IN SUCCULENT FEED, TO PRODUCTION, COST OF PRODUCTION, AND PROFITS

Per cent of milk sold during May, June, and July	Per cent of therms of winter succulent feed	Number of farms	Number of cows	Pounds of milk produced per cow			Cow cost of milk per 100 pounds	Profit or loss per cow	Value of feed except pasture, per cow	Pounds of milk produced to each dollar's worth of feed except pasture	
				Total for year	October to April inclusive	May to September inclusive				Total for year	Winter only
Less than 33	Under 10	24	298.5	5,313	3,067	2,246	\$1.94	-\$11	\$56	95	55
	10-30	17	213.0	5,950	3,598	2,352	1.83	— 7	62	97	58
	Over 30	15	286.5	6,222	3,888	2,334	1.68	+	64	97	60
From 33 to 40	Under 10	27	348.5	5,326	2,471	2,855	1.62	— 2	44	121	56
	10-30	14	285.0	5,519	2,699	2,820	1.69	— 4	55	100	49
	Over 30	11	183.5	5,444	2,592	2,852	1.64	— 1	51	106	51
More than 40	None	17	201.0	5,147	1,959	3,218	1.46	+	39	131	49
	Under 15	17	211.0	5,408	2,082	3,318	1.40	+	41	130	50
	15 or over	7	91.0	5,158	2,014	3,144	2.01	— 23	47	111	43

ing. With the summer system, which usually depends for its success on cheap winter feeding, some such means of furnishing a little succulence generally proves more economical than does costly silage fed regularly. Probably most cows do not get sufficient water, either because of infrequent waterings or because the water is very cold and they refuse to drink. Altho plenty of water is at all times desirable, it does not eliminate the advantages of succulent feed in the ration.

TABLE 92. RELATION OF SEASON OF MILK PRODUCTION AND FEEDING OF SILAGE TO NUTRIMENT USED PER UNIT OF PRODUCT IN WINTER
(Per 100 pounds of milk produced)

	Silage		No silage	
	Less than 36 per cent of milk sold during May, June, and July	36 per cent or more of milk sold during May, June, and July	Less than 36 per cent of milk sold during May, June, and July	36 per cent or more of milk sold during May, June, and July
Digestible nutrients (pounds).....	103.86	118.68	128.70	131.53
Digestible crude protein (pounds).....	13.42	14.62	15.75	15.32
Therms.....	92.83	106.79	112.20	114.88
Average butterfat test.	4.0	4.1	4.0	4.1
Per cent of milk produced in stabling period.....	59.7	46.2	56.2	42.7

TABLE 93. RELATION OF FEEDING OF SILAGE TO PERCENTAGE OF NUTRIMENT USED IN WINTER RATION RETURNED IN MILK PRODUCED IN WINTER

	Silage		No silage	
	Less than 36 per cent of milk sold during May, June, and July	36 per cent or more of milk sold during May, June, and July	Less than 36 per cent of milk sold during May, June, and July	36 per cent or more of milk sold during May, June, and July
Digestible nutrients*	17.2	15.1	13.9	13.6
Digestible crude protein†	24.6	22.6	21.0	21.5
Therms‡	31.3	27.2	25.9	25.3

* 17.9 pounds digestible nutrients to 100 pounds of milk. (*Feeds and Feeding*, by Henry and Morrison, page 657.)

† 3.3 pounds digestible protein to 100 pounds of milk. (*Feeds and Feeding*, by Henry and Morrison, page 657.)

‡ 29.01 therms to 100 pounds of milk. (Pennsylvania State College, Bulletin 143, page 23.)

With the silage rations, less nutriment was required for a hundred pounds of milk produced than with no-silage rations. The difference was greatest in the winter dairies. Perhaps a larger part of the no-silage ration was wasted or was used for bedding than of the silage ration. Also, the silage-

fed herds produced a larger proportion of milk in winter, and this tended to lower the nutriment used per unit of winter product.

A larger proportion of the nutriment fed in winter is returned with the silage rations than with no-silage rations and when more of the milk is produced in winter than when a relatively large proportion is produced in summer.

Relation of the feeding of silage and costs other than barn feed, to costs and returns.— Since the cost of barn feed is usually greater than all other costs of production combined, the question of feeding deserves the attention usually given it. But often the other costs are so high that even with economical feeding a large loss results. This may be due to extra time required in taking care of cows or in hauling milk, to expensive shelter, or to other excessive costs. It is therefore important also that the costs other than feed be studied on each farm. These costs depend much on the size of herd. But frequently they are low in small herds and high in large herds. Consequently, the number of cows is not always an indication of what are the costs other than feed.

In tables 94 and 95 there are considered four large groups of farms: winter dairies feeding silage and those not feeding silage, and summer

TABLE 94. RELATION OF COSTS PER COW, EXCEPT FOR BARN FEED, TO SIZE OF HERD, COST OF PRODUCTION, AND PROFITS, IN WINTER DAIRIES
(Less than 36 per cent of milk sold during May, June, and July)

Costs per cow except for barn feed	Number of farms	Number of cows per farm	Total costs per cow	Total returns per cow	Profit or loss per cow	Herd cost of milk per 100 pounds	Cow cost of milk per 100 pounds	Average cost except for barn feed	Value of barn feed
Herds fed silage:									
Under \$50.....	10	18.7	\$ 95	\$104	+\$ 9	\$1.49	\$1.48	\$41	\$54
\$50-\$65.....	27	16.6	120	118	— 2	1.80	1.77	56	64
Over \$65.....	9	9.8	138	111	— 27	2.27	2.22	75	63
Herds not fed silage:									
Under \$50.....	9	9.6	91	96	+	1.53	1.56	45	46
\$50-\$65.....	16	13.8	110	100	— 10	1.93	1.88	56	54
Over \$65.....	10	10.8	128	103	— 25	2.14	2.15	78	50

TABLE 95. RELATION OF COSTS PER COW, EXCEPT FOR BARN FEED, TO SIZE OF HERD, COST OF PRODUCTION, AND PROFITS, IN SUMMER DAIRIES
(36 per cent or more of milk sold during May, June, and July)

Costs per cow except for barn feed	Number of farms	Number of cows per farm	Total costs per cow	Total returns per cow	Profit or loss per cow	Herd cost of milk per 100 pounds	Cow cost of milk per 100 pounds	Average cost except for barn feed	Value of barn feed
Herds fed silage:									
Under \$50.....	11	16.6	\$ 87	\$ 94	+\$ 7	\$1.46	\$1.46	\$43	\$44
\$50-\$65.....	7	15.6	116	103	— 13	1.79	1.81	60	56
Over \$65.....	5	11.5	126	93	— 33	2.23	2.21	75	51
Herds not fed silage:									
Under \$50.....	23	14.4	80	92	+	1.26	1.30	41	39
\$50-\$65.....	17	11.4	102	97	— 5	1.69	1.67	57	45
Over \$65.....	5	9.4	110	100	— 10	1.77	1.73	69	41

dairies feeding silage and those not feeding silage. The intensity of the system lessens in the order given. The cost of production also decreases and profits increase as less intensive methods are used. That is, the cost of producing milk is least, and the profit per cow is greatest, in summer dairies not feeding silage which also keep the costs other than barn feed below \$50 a cow.

*Combined effect of large proportion of energy in both grains
and succulent feed*

Of the 56 dairies producing less than 33 per cent of the milk in May, June, and July, with an average of 51.9 per cent in the six months beginning October 1, there were 13 that used rations in which more than 25 per cent (average 32.4 per cent) of the energy was furnished by the grain and more than 30 per cent (average 39.5 per cent) was furnished by the succulent feed. There were 236.5 cows in these 13 herds, an average of 18.2 to a herd. The average production was 6253 pounds, the cost of milk \$1.57 a hundred pounds, and the profit \$10.93 a cow. These 13 herds each had only four more cows on the average than had the entire 56 herds, but the production averaged 431 pounds more, the profit was \$18 a cow higher, and the cost of production was 24 cents less per hundred pounds, than for the 56 herds.

The 13 herds used 78.6 therms per hundred pounds of milk produced in winter, as against an average of 95.75 therms for the 56 herds. Thus

TABLE 96. PRODUCTION, COST OF PRODUCTION PROFITS, AND ENERGY USED, WHEN MORE THAN 25 PER CENT OF THE THERMS IN THE WINTER RATION WERE IN GRAIN AND MORE THAN 30 PER CENT WERE IN SUCCULENT FEED

(Less than 33 per cent of milk sold during May, June, and July)

Number of farms.....	13
Number of cows.....	236.5
Cows per farm.....	18.2
Pounds of milk produced per cow.....	6,253
Cow cost of milk per hundredweight.....	\$1.57
Profit on each cow.....	\$10.93

	Therms per 100 pounds of milk produced			
	Pasture period (therms)	Winter period		Entire year (therms)
		Therms	Per cent	
Grain.....	4.0	25.5	32.4	17.3
Succulent feed.....	2.1	31.0	39.5	19.9
Dry forage.....	0.5	22.1	28.1	13.8
Total.....	6.6	78.6	100.0	51.0
Value of feed, except pasture, per hundredweight of milk produced....		\$0.94		
Value of feed, except pasture, per 100 therms.....		\$1.94		

it may be seen that feed was much more efficiently used when the ration carried a large proportion of the energy in grain and also a large proportion in succulent feed. The data are given in table 96.

Ration of the highest-producing and most profitable herd

The feed used by the highest-producing herd, which was also the herd showing the highest profit on cows, is shown in table 97:

TABLE 97. RATION OF THE HIGHEST-PRODUCING AND MOST PROFITABLE HERD

Number of cows.....				29
Pounds of milk produced per cow.....				8,392
Per cent of milk produced in seven months, October to April, inclusive..				71.8
Cost of milk per hundredweight.....				\$1.44
Profit per cow.....				\$42

Kind of feed	Pounds per cow per day in winter	Therms per pound	Therms per cow per day in winter	Per cent
Grain:				
High-protein:				
Brewers' dried grains.....	3.64	0.534	.....	.....
Dry equivalent of brewers' grains, wet	3.03	0.534	.....	.....
Cottonseed meal.....	0.49	0.900	.....	.....
Malt sprouts.....	0.65	0.727	.....	.....
Low-protein:				
Cornmeal.....	0.38	0.888	.....	.....
Wheat bran.....	0.73	0.530	.....	.....
Salt.....	0.26	.....	.....	.....
Total.....	9.18	.....	5.20	27.3
Succulent feed:				
Corn silage.....	66.66	0.120	8.00	.....
Mangels.....	11.39	0.057	0.65	.....
Total.....	78.05	.....	8.65	45.3
Dry forage:				
Clover hay (excellent quality).....	11.87	0.387	4.59	.....
Oat hay.....	1.95	0.322	0.63	.....
Total.....	13.82	.....	5.22	27.4
Total.....	.....	.....	19.07	.....

The farmer owning this herd fed one pound of grain for three pounds of milk in winter. His silage was good and he had excellent river-bottom clover hay for dry roughage. But 72.6 per cent of the energy of the winter ration came from grain and succulent feed, and 86 per cent of the energy of the grain was in high-protein feeds.

Practical feeders who make winter milk, know that there is more to skillful feeding than simply furnishing enough nutriment, enough protein, or enough energy. Altho this is essential, a proper share must come from grain, a proper share from succulent feed, and not too large a proportion from dry roughage, if the most economical production is to be

expected. A common recommendation has been that about one-third of the nutriment of the ration should be furnished by each of the three classes mentioned.

The findings of this investigation check closely with this recommendation. On the average, 40 per cent of the energy from grain, and from 35 to 40 per cent from succulent feed, gave the best results when the production was about equal in the pasture and winter periods. This allows for about 20 to 25 per cent from dry forage. It remains to be seen whether or not differences in the relative prices of grain, succulent feed, and dry forage, and in the quality of the hay, would affect these conclusions.

As showing the practical application of these findings in compounding rations, the following theoretical example may be applied: Let it be supposed that a cow produces in winter 30 pounds of 4-per-cent milk daily, and that one pound of grain is to be fed for each three pounds of milk. Then 10 pounds of grain ($30 \div 3$) would be fed daily. Assuming that 75 per cent, or thereabout, of the energy should come from high-protein feed, the daily grain ration might be as follows:

Kind of feed	Number of pounds	Number of therms per pound	Number of therms	Per cent of therms
High-protein:				
Gluten feed.....	4	0.807	3.228	42.1
Cottonseed meal.....	2	0.900	1.800	23.5
Oilmeal.....	1	0.889	0.889	11.6
Low-protein:				
Wheat bran.....	2	0.530	1.060	13.8
Ground oats.....	1	0.686	0.686	9.0
Total.....	10	.....	7.663	100.0

Assuming further that well-eared and well-matured corn silage and mixed hay will be fed, and that the following proportions are desired, then the requirements would be as follows:

	Per cent of energy of ration	Number of therms	Number of pounds required daily to furnish these therms
Grain.....	40	7.663	10.0
Succulent feed.....	35	6.705	42.2
Dry forage.....	25	4.790	11.7
Total.....	100	19.158	.....

Putney and Armsby standard for a 1000-pound cow, 14.1 therms

Production per cow

The production of milk per cow averaged less than 4500 pounds in 12 per cent of the herds studied, more than 4500 but not more than 5500 pounds in 39 per cent of the herds, more than 5500 but not more than 6500 pounds in 36 per cent of the herds, and more than 6500 pounds in 13 per cent of the herds. The lowest average herd production was 3258 pounds per cow and the highest was 8392 pounds. Records of individual cows were not obtained, but some were above and some were below these limits.

The herds with low average production had less cows than had those with higher production. The value of feed except pasture used by them was also less per cow for the former. In general, they are the herds following a less intensive system. Sorting by size of herd, season of production, and production per cow, tends to select the same herds in the extreme groups.

The figures showing the various production relationships are given in tables 98 to 100.

TABLE 98. RELATION OF PRODUCTION TO VARIOUS FACTORS

Pounds of milk produced per cow	Average pounds produced	Number of farms	Number of cows	Cows per farm	Value of feed except pasture per cow	Hundred-weight of milk sold	Per cent of farms on hills	Per cent of number of farms in group	Per cent of number of cows in group	Per cent of total milk sold by group
Under 4,500.....	4,063	18	235	13.1	\$41	8,598	78	12	11	8
4,500-5,500.....	4,961	58	746	12.9	47	33,592	67	39	36	32
5,501-6,500.....	5,916	54	783	14.5	53	42,767	63	36	38	41
Over 6,500.....	7,136	19	294	15.5	68	19,775	62	13	15	19

TABLE 99. RELATION OF PRODUCTION TO COSTS, RETURNS, AND PROFITS PER COW

Pounds of milk produced per cow	Average pounds produced	Pounds of milk sold per cow	Cost other than feed except pasture	Total cost per cow	Receipts per cow from milk sold	Total returns per cow	Profit or loss per cow	Per cent of farms showing a profit on cows
Under 4,500.....	4,063	3,659	\$50	\$ 91	\$ 58	\$ 75	-\$16	28
4,500-5,500.....	4,961	4,593	52	99	73	93	— 6	34
5,501-6,500.....	5,916	5,462	55	108	88	108	0	46
Over 6,500.....	7,136	6,727	58	126	115	134	+ 8	58

The average cost of keeping cows producing 4063 pounds of milk was \$91, of cows producing 4961 pounds \$99, of cows producing 5916 pounds \$108, and of cows producing 7136 pounds \$126, per cow. The returns for the respective groups were \$75, \$93, \$108, and \$134 per cow. There was a loss of \$16 per cow in the group of lowest production, but a gain of \$8 per cow in the group of highest production. Feed costs, and the other costs as well, increased as better yields were obtained.

TABLE 100. RELATION OF PRODUCTION TO COST OF PRODUCTION AND AVERAGE PRICE FOR PRODUCT

Pounds of milk produced per cow	Average pounds produced	Cost of milk per 100 pounds		Cow cost compared with average	Relative cow cost taking first group as 100	Decrease in cow cost below preceding group	Price received per 100 pounds of milk sold
		Herd cost	Cow cost				
Under 4,500.....	4,063	\$1.98	\$2.00	+\$0.31	100	.....	\$1.59
4,500-5,500.....	4,961	1.76	1.75	+ 0.06	88	\$0.25	1.62
5,501-6,500.....	5,916	1.63	1.63	- 0.06	82	0.12	1.61
Over 6,500.....	7,136	1.65	1.61	- 0.08	80	0.02	1.71

Per cow

\$140

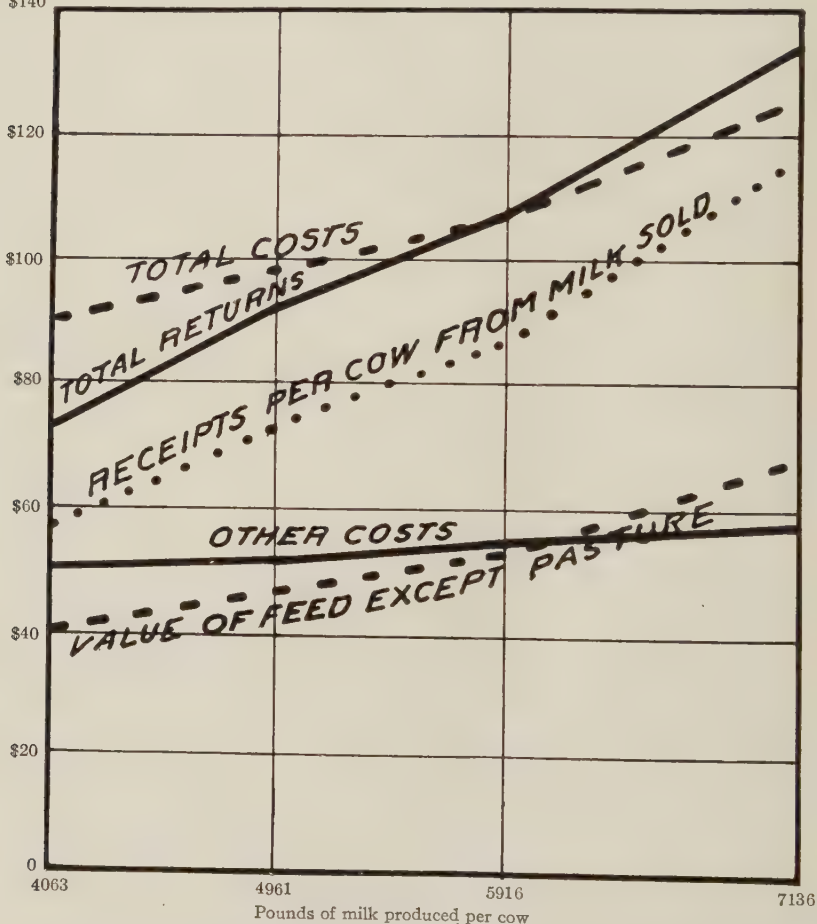


FIG. 62. RELATION OF PRODUCTION PER COW TO COSTS AND RETURNS

In the herds of low average yields the costs were less per cow, but much higher per hundred pounds of milk, than in herds with high average production. For cows producing less than 4500 pounds of milk, with an average

of 4063 pounds, the cow cost of milk was \$2 per hundred pounds; with an average production of 4961 pounds, the cost was \$1.75 per hundred pounds; with an average production of 5916 pounds, the cost was \$1.63 per hundred pounds; and in the group containing the highest-producing herds, with an average of 7136 pounds, the cost was \$1.61 per hundred pounds.

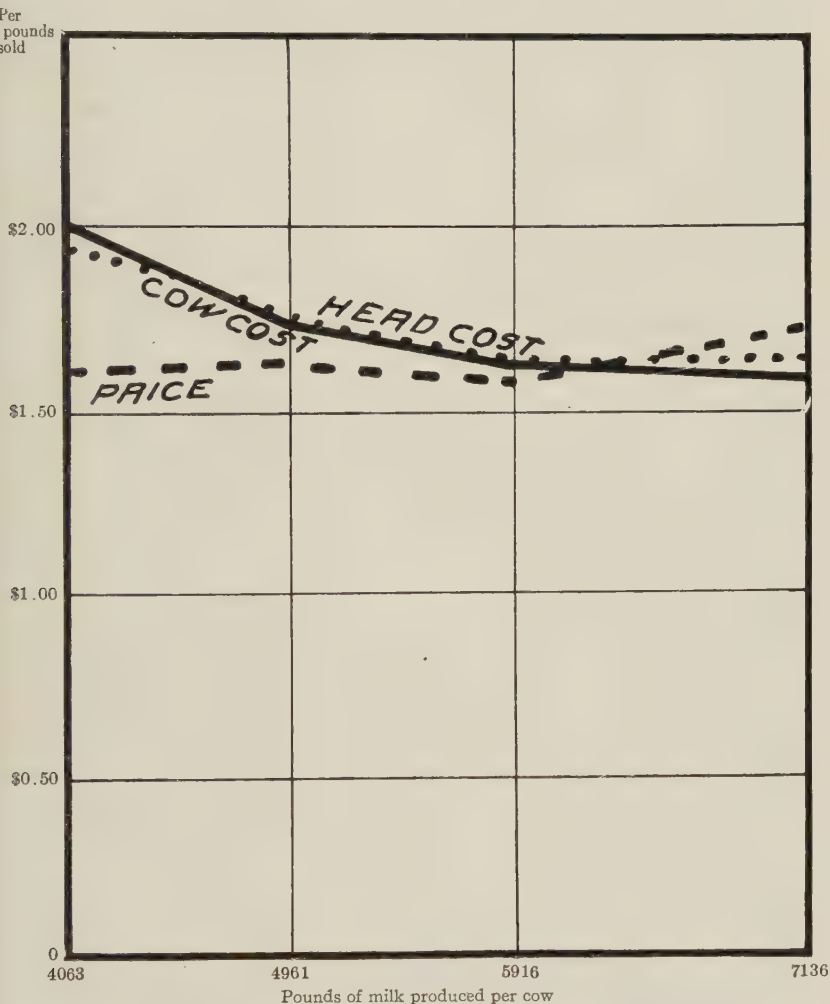


FIG. 63. RELATION OF PRODUCTION PER COW TO COST OF MILK

The herd cost of milk was not so closely correlated with production as was the cow cost. In low-producing herds the herd cost was less than the cow cost. This indicates that in these herds there was a gain on heifers. On the other hand, in high-producing herds the herd cost was greater than the cow cost. In other words, a loss on heifers in these herds increased the cost of milk.

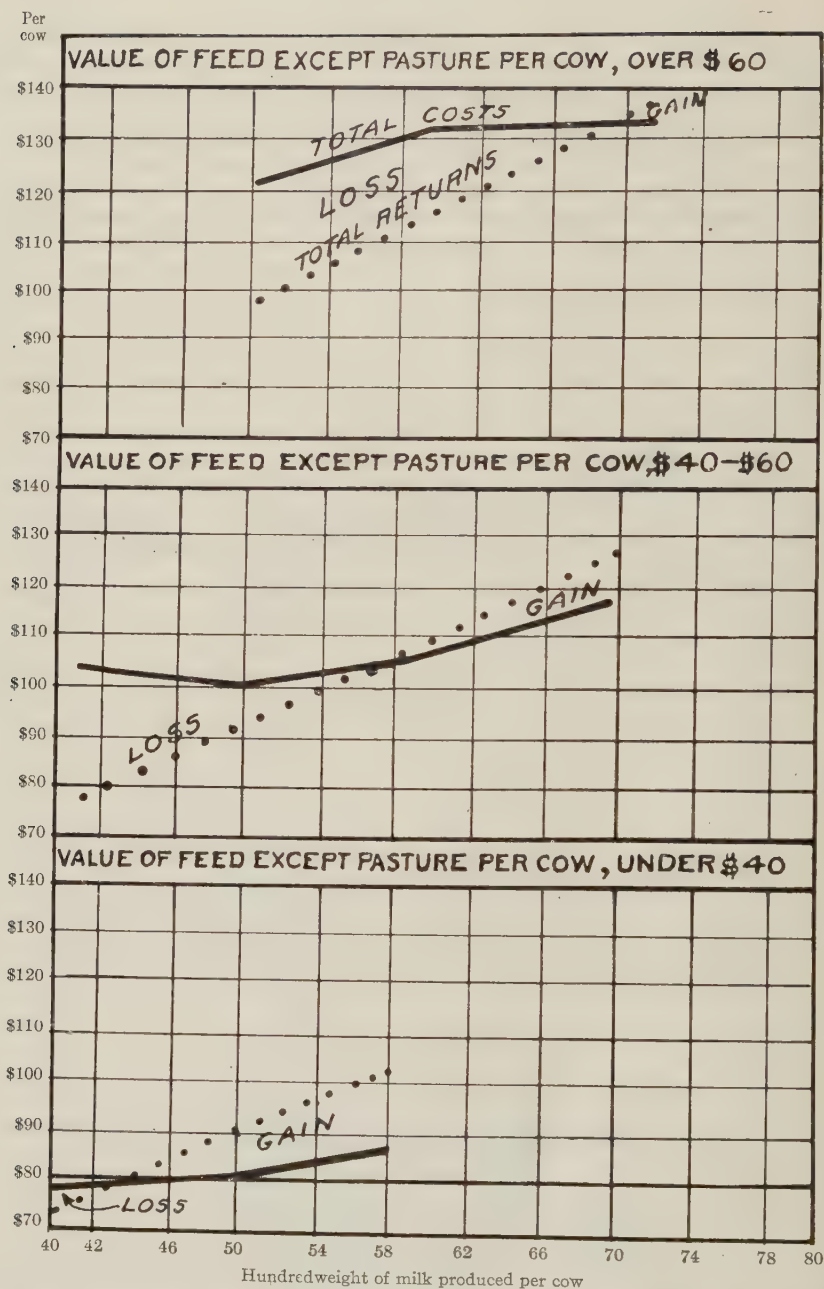


FIG. 64. RELATION OF PRODUCTION AND INTENSITY OF FEEDING TO COSTS AND RETURNS
More milk is necessary to show a profit with intensive feeding, than with light barn feeding and the summer system

Intensity of feeding

Herds that averaged the highest in production at the least expenditure for barn feed showed the greatest margin of profit. The greatest loss occurred when low production resulted with an expensive winter ration. The statement is often made that it costs no more to keep a high-yielding cow than a poor one, except for feed, but when more feed is given the other costs are increased also. More time is required in the feeding, in milking, and in the care of the higher-yielding cow, and many of the other costs are higher. Hence this statement is rarely true.

Of the 149 dairymen included in this study, only 11 made a systematic practice of weighing the milk from each cow, 22 kept the statements of the amount of milk sold, and 20 were in cow-testing associations. Other than this there were practically no records of production kept. Cows should be culled closer than ever before, and to do this most intelligently records of production are essential. In many cases these should be supplemented by records of feed used. Both are necessary for the most careful dairying.

The question of how much milk it is necessary for a cow to give in order to show profit is often discussed. This question can never be definitely answered. Much depends on the intensity of the system. When cows are carried thru the winter largely on roughage with little grain, a profit may result with lower production than when heavy winter feeding is the practice.

The relation of production and intensity of feeding to costs and returns is shown in figure 64 and table 101:

TABLE 101. RELATION OF PRODUCTION AND INTENSITY OF FEEDING TO COSTS AND RETURNS

Value of feed except pasture per cow	Pounds of milk produced per cow			
	Under 4500	4500- 5500	5501- 6500	Over 6500
Less than \$40:				
Number of farms.....	10	19	9	
Cows per farm.....	12.6	11.4	13.9	
Value of feed except pasture per cow.....	\$34	\$35	\$35	
Total costs per cow.....	\$79	\$80	\$87	
Pounds of milk produced per cow.....	3,997	4,909	5,759	
Receipts per cow from milk sold.....	\$55	\$69	\$85	
Total returns per cow.....	\$73	\$90	\$102	
Profit or loss per cow.....	-\$6	+\$10	+\$15	
Herd cost of milk per hundred pounds.....	\$1.65	\$1.31	\$1.32	
Cow cost of milk per hundred pounds.....	\$1.70	\$1.34	\$1.31	
Amount received for milk sold per hundred pounds.....	\$1.55	\$1.56	\$1.59	
Per cent of herds showing a profit on cows.....	40	63	78	Only one herd in this group

TABLE 101 (concluded)

Value of feed except pasture per cow	Pounds of milk produced per cow			
	Under 4,500	4,500- 5,500	5,501- 6,500	Over 6,500
From \$40 to \$60:				
Number of farms.....	8	28	34	7
Cows per farm.....	13.7	14.0	14.1	11.0
Value of feed except pasture per cow..	\$48	\$48	\$51	\$50
Total costs per cow.....	\$104	\$100	\$106	\$117
Pounds of milk produced per cow...	4,138	4,955	5,910	7,009
Receipts per cow from milk sold....	\$61	\$74	\$88	\$110
Total returns per cow.....	\$77	\$93	\$107	\$126
Profit or loss per cow.....	—\$27	—\$7	+\$1	+\$9
Herd cost of milk per hundred pounds	\$2.34	\$1.82	\$1.59	\$1.51
Cow cost of milk per hundred pounds.	\$2.33	\$1.80	\$1.58	\$1.51
Amount received for milk sold per hundred pounds.....	\$1.62	\$1.65	\$1.61	\$1.65
Per cent of herds showing a profit on cows.....	12	25	50	71
More than \$60:				
Number of farms.....		11	11	11
Cows per farm.....		12.6	16.4	18.0
Value of feed except pasture per cow..		\$65	\$71	\$77
Total costs per cow.....		\$122	\$131	\$134
Pounds of milk produced per cow...		5,058	6,039	7,184
Receipts per cow from milk sold....		\$79	\$92	\$119
Total returns per cow.....		\$98	\$115	\$137
Profit or loss per cow.....		—\$24	—\$16	+\$3
Herd cost of milk per hundred pounds		\$2.19	\$1.94	\$1.77
Cow cost of milk per hundred pounds.		\$2.19	\$1.96	\$1.71
Amount received for milk sold per hundred pounds.....		\$1.68	\$1.66	\$1.76
Per cent of herds showing a profit on cows.....		9	9	45

Relation of production to diminishing returns

Low production, either because of poor cows or of scant feeding, usually requires more feed per unit of product than does higher production. Beyond a certain point, however, each additional pound of product requires more and more feed until the limit of the capacity of a cow to take feed is reached. Hence, highest yields require more feed per unit of product than do medium good yields. Except in the making of advanced registry records, rarely does it pay to force cows to the limit of their capacity.

In the group of herds with cows that produced less than 4500 pounds of milk, with an average production of 4063 pounds, 100 pounds of milk were produced for each dollar's worth of feed except pasture; in the next group, with an average production of 4961 pounds, this figure was 106 pounds; with an average production of 5916 pounds, for cows in the next

group, it was 111 pounds; and in the group including cows with the highest production, averaging 7136 pounds, only 105 pounds of milk were produced for each dollar's worth of barn feed (fig. 65 and table 102.)

Pounds of milk produced
for each dollar's worth
of feed except pasture

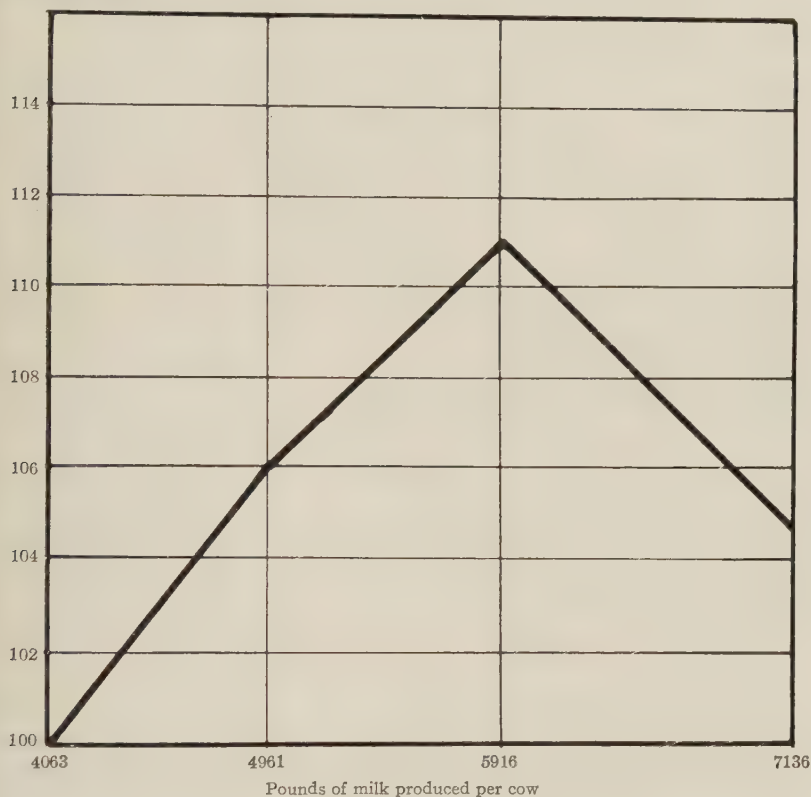


FIG. 65. RELATION OF PRODUCTION PER COW TO DIMINISHING RETURNS

It may so happen, however, that by obtaining high production at the time of year when milk sells for the highest price, altho more feed is required the increased value of the product is more than enough to pay the extra cost of feed and all the other costs. Therefore the point of greatest profit on a cow, or on a herd, does not necessarily accompany that production at which the greatest quantity of milk is obtained per unit of feed. Usually it is beyond that point.

Cows averaging 4961 pounds of milk produced 898 pounds more than the first group, at an additional cost of \$8; cows averaging 5916 pounds produced 955 pounds more than the second group, at an additional cost of \$9; and cows averaging 7136 pounds produced 1220 pounds more than the third group, at an additional cost of \$18. As production increased, less

and less milk was produced per dollar of additional expense. When the increased production was 898 pounds, 112 pounds additional were obtained for each dollar of increased cost; when the increased production was 955 pounds, 106 pounds additional were obtained for each increase of one dollar in cost; but when the increased production was 1220 pounds, only 68 pounds additional were obtained for each dollar of increased cost.

TABLE 102. RELATION OF PRODUCTION PER COW TO DIMINISHING RETURNS

	Pounds of milk produced per cow			
	Under 4500	4500- 5500	5501- 6500	Over 6500
Average pounds of milk produced.....	4,063	4,961	5,916	7,136
Increase in pounds of milk per cow over pre- ceding group.....		898	955	1,220
Increase in total cost per cow over preceding group.....		\$8	\$9	\$18
Increase in pounds of milk produced per dollar of increased cost.....		112	106	68
Increase in receipts per cow from milk sold over preceding group.....		\$15	\$15	\$27
Increase in receipts per cow from milk sold per dollar of increased cost.....		\$1.88	\$1.67	\$1.50
Increase in returns per cow over preceding group.....		\$18	\$15	\$26
Increase in returns per dollar of increased cost ..		\$2.25	\$1.67	\$1.44
Increase in receipts from milk sold per dollar of increase in feed except pasture.....		\$2.50	\$2.50	\$1.80
Pounds of milk produced per dollar's worth of feed except pasture.....	100	106	111	105

An increase in production of 898 pounds per cow resulted in increased returns to the amount of \$2.25 for each dollar of increased cost; a further increase of 955 pounds per cow resulted in increased returns of \$1.67 per dollar of increased cost; but a still further increase of 1220 pounds per cow brought increased returns of only \$1.44 per dollar of increased cost.

From these results it appears that, even in the highest-producing group, the point beyond which it would no longer pay to increase production has not been reached. But a mistake frequently made in judging how far yields may be profitably carried is to compare the receipts per cow from milk sold with the value of feed except pasture used. On this basis an increase in production of 898 pounds of milk would have resulted in increased receipts for milk sold, of \$2.50 for each additional dollar spent for barn feed, a further increase of 955 pounds would have brought the same return, and the last increase of 1220 pounds would have resulted in increased receipts of \$1.80 for each additional dollar's worth of feed except pasture. These figures are, respectively, 11, 50, and 25 per cent higher than when

total costs and total returns are considered, and any such method of calculation is misleading because it favors too intensive methods. All of the costs and all of the returns should be considered.

Increased returns per
dollar of additional cost
over preceding group

\$3.00

\$2.25

\$1.50

\$0.75

0

4063

4961

5916

7136

Pounds of milk produced per cow

CONSIDERING MILK SOLD AND
BARN FEED
CONSIDERING TOTAL COSTS AND
TOTAL RETURNS

FIG. 66. CORRECT AND INCORRECT METHODS OF CALCULATING INCREASED RETURNS
The incorrect practice of considering as profit the difference between the value of barn feed and receipts from milk, favors too intensive methods. All the costs and returns should be considered

*Relation of production and season of production to intensity
of feeding and to costs and returns*

Of the farmers getting more than 6500 pounds of milk per cow, 79 per cent fed more than 1500 pounds of grain. The average for winter dairies was about one ton per cow. When the production averaged less than 4500 pounds per cow, none of the farmers used more than 1500 pounds of grain per cow except in winter dairies, where one-fourth of the farmers exceeded this amount. With this production, 61 per cent of the farmers used less than 1000 pounds per cow. (Table 103.) The number of herds and cows in each group are given in table 105.

TABLE 103. RELATION OF PRODUCTION AND SEASON OF PRODUCTION TO INTENSITY OF FEEDING

Per cent of milk sold during May, June, and July	Pounds of milk produced per cow			
	Under 4500	4500- 5500	5501- 6500	Over 6500
Less than 33:				
Pounds of grain fed per cow:				
Maximum.....	1,700	2,309	2,777	2,939
Minimum.....	719	677	979	1,214
Average.....	1,172	1,394	1,786	2,029
Per cent feeding:				
Less than 1000 pounds of grain per cow....	25	23	.....	.....
1000-1500 pounds.....	50	36	44	17
More than 1500 pounds.....	25	41	56	83
Value of feed except pasture per cow:				
Maximum.....	\$58	\$78	\$85	\$96
Minimum.....	\$30	\$36	\$36	\$48
Average.....	\$48	\$53	\$60	\$74
From 33 to 40:				
Pounds of grain fed per cow:				
Maximum.....	1,000	2,153	2,213	2,450
Minimum.....	548	593	890	974
Average.....	853	1,300	1,416	1,708
Per cent feeding:				
Less than 1000 pounds.....	88	17	5	20
1000-1500 pounds.....	12	50	47	.....
More than 1500 pounds.....	.....	33	48	80
Value of feed except pasture per cow:				
Maximum.....	\$49	\$78	\$74	\$74
Minimum.....	\$32	\$31	\$31	\$39
Average.....	\$40	\$48	\$52	\$53
More than 40:				
Pounds of grain fed per cow:				
Maximum.....	1,200	1,550	2,658	1,629
Minimum.....	429	631	673	1,169
Average.....	873	1,026	1,311	1,341
Per cent feeding:				
Less than 1000 pounds.....	50	39	40	.....
1000-1500 pounds.....	50	50	33	50
More than 1500 pounds.....	.....	11	27	50
Value of feed except pasture per cow:				
Maximum.....	\$45	\$62	\$72	\$53
Minimum.....	\$24	\$28	\$32	\$44
Average.....	\$36	\$39	\$45	\$47

The difference in cost of production and profit due to increased production up to 6500 pounds is not so striking with summer dairies as it is with winter dairies, because higher yields are more difficult to obtain with spring-fresh cows and the summer system than with fall-fresh cows. In winter dairies, increased yield from 4234 pounds to 5974 pounds per cow was accompanied by a decrease of 42 cents in the cow cost of production and a decrease in loss of \$20 per cow. In summer dairies, increased production from 3988 pounds to 5815 pounds was accompanied by a decrease in cost of 31 cents and a decrease in loss of \$12 per cow. (Tables 104 and 105.)

TABLE 104. RELATION OF PRODUCTION AND SEASON OF PRODUCTION TO COST OF PRODUCTION AND PROFITS

Per cent of milk sold during May, June, and July	Pounds of milk produced per cow			
	Under 4500	4500- 5500	5501- 6500	Over 6500
Less than 33:				
Total costs per cow.....	\$101	\$107	\$118	\$135
Total returns per cow.....	\$79	\$98	\$116	\$138
Profit or loss per cow.....	-\$22	-\$9	-\$2	+\$3
Per cent showing profit on cows.....	0	36 1	44	50
Herd cost of milk per hundred pounds.....	\$2.15	\$1.94	\$1.76	\$1.78
Cow cost of milk per hundred pounds.....	\$2.18	\$1.90	\$1.76	\$1.72
From 33 to 40:				
Total costs per cow.....	\$90	\$97	\$106	\$104
Total returns per cow.....	\$76	\$91	\$107	\$126
Profit or loss per cow.....	-\$14	-\$6	+\$1	+\$22
Per cent showing profit on cows.....	25	28	43	80
Herd cost of milk per hundred pounds.....	\$1.96	\$1.74	\$1.60	\$1.30
Cow cost of milk per hundred pounds.....	\$2.00	\$1.74	\$1.59	\$1.27
More than 40:				
Total costs per cow.....	\$82	\$89	\$100	\$114*
Total returns per cow.....	\$71	\$89	\$101	\$116
Profit or loss per cow.....	-\$11	0	+\$1	+\$2
Per cent showing profit on cows.....	50	39	53	50
Herd cost of milk per hundred pounds.....	\$1.86	\$1.51	\$1.51	\$1.57
Cow cost of milk per hundred pounds.....	\$1.83	\$1.55	\$1.52	\$1.52

*Only two herds in this group.

Relation of production to value of cows

It has already been shown that cows were held at a higher value in the larger herds and when more winter milk was produced. But the factor most strikingly correlated to the value of a cow is the amount of milk she gives.

Cows in herds averaging 4063 pounds of milk had an average value of \$58, while those in herds producing 7136 pounds had an average value of \$75. Altho the better-producing cows were held at higher prices, it may be seen in table 105 that they produced about 25 pounds of milk more per dollar invested in them than did poor cows. To allow for as much milk production per dollar of investment as for the higher-yielding cows, it would have been necessary to value the lower producers at \$43 instead of at \$58 a head.

Since the relationship between season of production and value of cows, and that between production and value of cows, are so marked, it might be expected that cows in low-yielding dairies with largely summer production would be held for the least price and cows in high-yielding dairies with more intensive methods would be held at the highest figure. That this is true may be seen in table 105. It is further shown in this table that cows in summer dairies produce less milk per dollar invested than do cows

in the other herds, but good-producing cows are held at equally high values with summer production or with winter production.

TABLE 105. RELATION OF PRODUCTION AND SEASON OF PRODUCTION TO VALUE OF COWS

Per cent of milk sold during May, June, and July	Pounds of milk produced per cow				Average	Pounds of milk produced per \$1 in value	Value of cows per hundred- weight of milk produced
	Under 4500	4500- 5500	5501- 6500	Over 6500			
Less than 33:							
Number of farms.....	4	22	18	12	.....	.....	.....
Number of cows.....	50.5	290.5	231.5	205.5	.....	.....	.....
Value per cow.....	\$60	\$64	\$62	\$77	.....	.....	\$1.15
Pounds of milk produced.....	4,234	5,003	5,974	7,184	5,822	87	.....
From 33 to 40:							
Number of farms.....	8	18	21	5	.....	.....	.....
Number of cows.....	125.5	242.5	326.0	63.0	.....	.....	.....
Value per cow.....	\$61	\$59	\$65	\$69	.....	.....	\$1.16
Pounds of milk produced.....	4,029	4,978	5,935	7,133	5,412	86	.....
More than 40:							
Number of farms.....	6	18	15	2	.....	.....	.....
Number of cows.....	59.0	213.0	205.5	25.5	.....	.....	.....
Value per cow.....	\$51	\$64	\$68	\$75	.....	.....	\$1.24
Pounds of milk produced.....	3,088	4,885	5,815	6,761	5,255	81	.....
Average production per cow....	4,063	4,061	5,016	7,136	5,532	.....	.....
Average value of cows per head..	\$58	\$63	\$65	\$75	\$65	.....	.....
Pounds of milk produced per \$1 in value of cows.....	70	79	91	95	.....	86	.....
Value per hundredweight of milk produced.....	\$1.43	\$1.26	\$1.10	\$1.05	.....	.....	\$1.17

Combined effect of size of herd, season of production, and production per cow, on costs and returns

The highest cost of production and the largest losses are in the small, low-producing herds, making a large share of their product in winter, while the lowest cost of production and the largest gains are made in the large, high-producing herds, making a large proportion of milk in summer. This at once emphasizes the importance of seeking an adjustment in all three of these factors if one would expect the greatest returns from his dairy.

Some dairies do well in spite of the handicap of a small herd, in spite of poor cows, or in spite of the fact that the system is not of the proper intensity for the greatest profits under the conditions. With a large herd one may make a profit on lower-producing cows. When the cows are unusually good, it is possible to succeed well with a smaller number. If the system is one that depends largely on cheap pasture, it may pay even tho the farmer is not fully employed thruout the winter. But it is extremely difficult to make a dairy pay well under all of these handicaps. If the herd is small and the cows are poor, increasing the numbers may result in greater loss. If it is desired to change to a more intensive system, the cows may be too poor to make a profit on costly winter feed. Thus it is evident that one cannot afford to disregard the

close interrelation of all points of the business. Matters of herd improvement should always receive much attention. But if one is to expect the greatest returns from the use of better stock, it is necessary that he should work with reasonably large numbers. When one has a large herd of high-class cattle, he can little afford to use extensive methods in their feeding and care.

The data on relation of size of herd, season of production, and production per cow, to cost of production and profits, are given in table 106:

TABLE 106. RELATION OF SIZE OF HERD, SEASON OF PRODUCTION, AND PRODUCTION PER COW, TO COST OF PRODUCTION AND PROFITS

Per cent of milk sold during May, June, and July	Pounds of milk produced per cow					
	Under 5000		5000-6000		Over 6000	
	Number of cows per farm					
	Less than 15	15 or more	Less than 15	15 or more	Less than 15	15 or more
Less than 33:						
Number of farms.....	10	5	12	8	13	8
Cows per farm.....	10.6	10.3	10.0	20.0	9.9	25.2
Total cost per cow.....	\$106	\$110	\$116	\$103	\$135	\$126
Total returns per cow.....	\$88	\$93	\$108	\$104	\$127	\$134
Profit or loss per cow.....	-\$18	-\$17	-\$8	+\$1	-\$8	+\$8
Herd cost of milk per hundred pounds.....	\$2.12	\$2.15	\$1.89	\$1.75	\$1.88	\$1.69
Cow cost of milk per hundred pounds.....	\$2.11	\$2.10	\$1.90	\$1.67	\$1.84	\$1.65
From 33 to 40:						
Number of farms.....	14	4	10	9	8	7
Cows per farm.....	10.9	19.5	10.8	21.8	10.1	20.2
Total cost per cow.....	\$98	\$91	\$111	\$93	\$108	\$108
Total returns per cow.....	\$85	\$75	\$98	\$97	\$115	\$117
Profit or loss per cow.....	-\$13	-\$16	-\$13	+\$4	+\$7	+\$9
Herd cost of milk per hundred pounds.....	\$1.93	\$1.95	\$1.91	\$1.50	\$1.51	\$1.45
Cow cost of milk per hundred pounds.....	\$1.94	\$2.02	\$1.87	\$1.50	\$1.47	\$1.45
More than 40:						
Number of farms.....	16	3	11	7	3	Only one farm in this group
Cows per farm.....	9.7	18.0	10.7	17.9	11.7	
Total cost per cow.....	\$86	\$91	\$104	\$85	\$124	
Total returns per cow.....	\$80	\$82	\$98	\$100	\$114	
Profit or loss per cow.....	-\$6	-\$9	-\$6	+\$15	-\$10	
Herd cost of milk per hundred pounds.....	\$1.71	\$1.67	\$1.68	\$1.21	\$1.65	
Cow cost of milk per hundred pounds.....	\$1.70	\$1.75	\$1.66	\$1.24	\$1.72	

Butterfat test of milk

With one exception, all the companies included in this study tested the milk delivered by each patron two or three times monthly. These tests were made from composite samples kept from daily deliveries. The test for the month as reported to the dairymen was an average of these samples.

This average test for each month of the year was obtained from the companies' records for each of 114 farms. For the remaining 35 farms no data as to the test for various months were obtainable. In order not to include any estimates on this part of the work, these records were omitted from the tabulations concerning test of milk.

The amount of butterfat sold each month was calculated for each of the 114 farms by multiplying the number of pounds of milk sold by the average test for the month. An estimated average test for the year was

used in calculating the fat in the small quantities of milk retailed. The total number of pounds of fat in the milk sold was then divided by the number of pounds of milk sold to determine the average butterfat test for the year. In other parts of the work it has been assumed that the milk from the 35 farms tested the same as that from the 114 farms.

Variation in test

The average test for the year varied from 3.5 per cent to 4.8 per cent. There were three herds that averaged 3.5 per cent and five herds that averaged over 4.5 per cent. The average test for all herds was 4 per cent for the year.

The monthly variation in the test of milk was greater when a large proportion of the milk was produced in summer. Probably this was partly

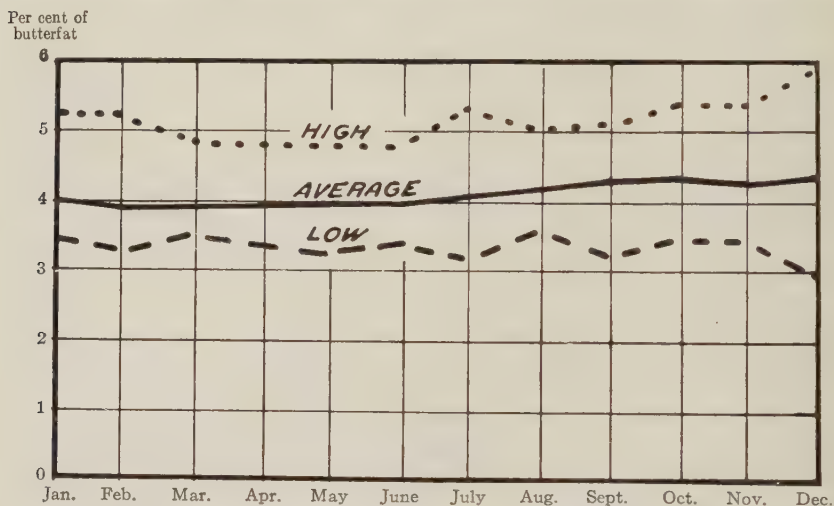


FIG. 67. MAXIMUM, MINIMUM, AND AVERAGE MONTHLY BUTTERFAT TESTS

because more of the cows came fresh at about the same time and dried off together.

The curve for the group of herds producing summer milk (fig. 68) shows the effect of advance in lactation period on the fat content of the milk. If it is assumed that on the average the cows in this group freshened on April 1, then the increase in the percentage of butterfat in the milk would be 0.7 per cent in nine months. This would be more of a relation between the number of days in milk and the fat content than Eckles found for twenty Jersey cows giving richer milk.¹¹ Since not all the cows in this group freshened in April, there is probably even more relation in these herds between the stage of lactation and the percentage of fat in the milk than the figures indicate.

¹¹ *Dairy Farming* (Eckles and Warren), page 69.

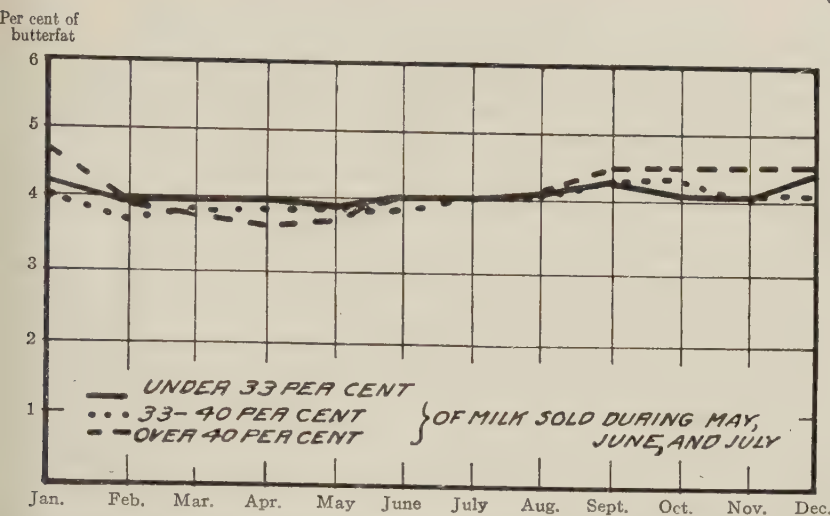


FIG. 68. RELATION OF SEASON OF MILK PRODUCTION TO MONTHLY BUTTERFAT TEST OF MILK

The milk from herds following the summer system tested lower in the spring months and higher in the winter months than that from herds following a more intensive system. In summer the test was about the same for the two systems

Relation of test of milk to production

There was little difference in the relative amount of milk produced in summer by herds producing milk of different butterfat content. The average milk production in the herds that tested less than 3.8 per cent was 5844 pounds per cow; in those that tested from 3.8 to 4 per cent it was 5495 pounds; in those testing from 4.1 to 4.2 per cent it was 5092 pounds; and in those testing more than 4.2 per cent it was 5271 pounds. (Table 107.)

TABLE 107. RELATION OF TEST OF MILK TO PRODUCTION AND SEASON OF PRODUCTION ON 114 FARMS REPORTING BUTTERFAT TEST BY MONTHS

Per cent of butterfat in milk	Average per cent of butterfat	Number of farms	Number of cows	Number of cows per farm	Pounds of milk		Pounds of fat in milk sold per cow	Per cent of milk sold during May, June, and July
					Pro-duced per cow	Sold per cow		
Less than 3.8.....	3.6	13	167.0	12.8	5,844	5,313	193	31
From 3.8 to 4.0.....	3.9	46	663.5	14.4	5,495	5,028	196	34
From 4.1 to 4.2.....	4.1	26	299.0	11.5	5,092	4,662	193	36
More than 4.2.....	4.4	29	343.0	11.8	5,271	4,782	210	34
Total.....	4.0	114	1,472.5	12.9	5,400	4,929	198	34
Average.....	4.0	.....	.....	.....	.....	.....	.....	.....

Relation of test of milk to costs and returns

The total cost and the returns per cow were higher in the low-testing than in the high-testing herds. The returns just equaled the costs in the case of herds testing the least. In the higher-testing herds there was a loss of from \$4 to \$8 on each cow. (Table 108.)

TABLE 108. RELATION OF TEST OF MILK TO COSTS AND RETURNS ON 114 FARMS REPORTING BUTTERFAT TEST BY MONTHS

Per cent of butterfat in milk	Total cost per cow	Receipts per cow from milk sold	Total returns per cow	Profit or loss per cow	Herd cost of milk per 100 pounds	Cow cost of milk per 100 pounds	Per cent of herds showing profit on cows
Less than 3.8.....	\$110	\$90	\$110	0	\$1.71	\$1.69	46
From 3.8 to 4.0.....	108	81	101	—7	1.77	1.75	39
From 4.1 to 4.2.....	103	75	95	—8	1.77	1.78	23
More than 4.2.....	105	81	101	—4	1.80	1.77	45
Average.....	\$106	\$81	\$101	—5	\$1.77	\$1.75	38

The cost of producing milk rich in butterfat was more than for that with a lower test. The herd cost of producing milk that tested 3.6 per cent butterfat was \$1.71; the cow cost was \$1.69 per hundredweight. But the herd cost of producing milk that tested 4.4 per cent of butterfat was \$1.80 and the cow cost was \$1.77 per hundredweight. Since the range of variation in the butterfat test of milk was not wide, the difference in the cost between groups was less than if there had been more variation in the richness of the milk.

Comparison of hill and valley farms

Of the 99 hill dairies, 40 had less than twelve cows, 43 had from twelve to eighteen cows, and 16 had more than eighteen cows. Among the 50 valley farms there were 23 with less than twelve cows, 14 with from twelve to eighteen cows, and 13 with more than eighteen cows.

Location

So far as markets, soil, and growing season are concerned, hill farms are less favorably located for almost any profitable type of farming than are valley farms. With the exception of sixteen dairymen who sold to the milk station at Tunnel, all the dairymen on these farms sold their milk to stations located in the valleys. Twelve of the hill farms were more than 8.5 miles from the milk station, but none of the valley farms were at this distance.

The average distance to the milk stations was 4.4 miles from the 99 hill farms and 3.1 miles from the 50 valley farms, a difference of 1.3 miles, or 2.6 miles for each trip with milk or to get feed. In addition, the roads to the hills are steep. Valley farms are thus more accessible to milk stations, railroads, feed mills, and towns. Hence the cost of delivering milk to market for the hill farms is greater. Even tho many of the hill dairymen hired their milk hauled, the cost per hundredweight averaged 22 cents as against 13 cents for the valley farms. The cost of hauling feed to be ground and of hauling feed purchased is also higher.

The elevation of the hill farms varied from 850 to about 1800 feet, while that of the valleys ranged from about 800 to about 900 feet. This

gives the valley farms an advantage in the production of practically all farm crops. On the hills 9.3 acres were farmed, of which 3.2 acres were pastured for each cattle unit kept; while in the valleys 7.8 acres were farmed, of which 2.6 acres were pastured for each cattle unit kept. The upland pastures suffer more from drought than do the pastures nearer the valleys, and do not hold grass well. As a consequence, more land is required to furnish summer feed for an animal. This, together with the fact that the land is more hilly and farther from market, makes it worth less per acre. The cost of pasture per animal is less on the hills.

The average value of pasture land on the hill farms was \$15 an acre, while on the valley farms it was \$32 an acre. In view of this, the pasture costs were \$3.71 per cow on the hills and \$6.02 per cow in the valleys. The valley crop land is more productive, which allows the keeping of more stock there during the winter. Therefore the hill farms are not so heavily stocked.

Size of dairy business

On the hill farms an average of 13.3 cows were kept on 158 acres, of which 54 acres were pastured (table 109). The largest of these farms comprised 700 acres and kept fifteen cows and thirteen heifers. Nine farms

TABLE 109. COMPARISON OF HILL AND VALLEY DAIRIES AS TO SIZE OF THE DAIRY BUSINESS

	Number of cows per farm							
	Under 12		12-18		Over 18		Average	
	Hill	Valley	Hill	Valley	Hill	Valley	Hill	Valley
Number of farms.....	40	23	43	14	16	13	99	50
Acres farmed.....	130	94	168	135	205	279	158	153
Acres pastured.....	41	26	59	48	76	97	54	51
Average miles to milk station.....	4.8	3.6	3.9	3.4	4.5	1.9	4.4	3.1
Number of cows.....	9.0	8.7	14.3	14.9	21.8	25.2	13.3	14.7
Number of heifers.....	4.7	4.7	6.6	7.2	7.4	15.7	6.0	8.2
Cattle units.....	11.9	11.6	18.4	19.5	26.4	34.1	17.0	19.7
Hundredweight of milk sold.....	447	401	704	730	1,115	1,485	667	775
Receipts from milk sold....	\$719	\$668	\$1,137	\$1,203	\$1,810	\$2,519	\$1,077	\$1,299
Acres per cattle unit.....	10.9	8.1	9.1	6.9	7.8	8.2	9.3	7.8
Value of pasture land per acre.....	\$15	\$41	\$15	\$39	\$14	\$24	\$15	\$32

kept less than eight cows, the smallest number being six. Of these, four contained from 37 to 92 acres, and five contained from 104 to 200 acres. On each of eight hill farms containing from 130 to 339 acres, more than twenty cows were kept. The largest of these herds contained thirty cows, on a 280-acre farm, from which 1456 hundredweight of milk was sold for \$2390. On the average 667 hundredweight of milk, returning \$1077, was sold per hill farm. The largest total receipts for milk sold from a hill farm was \$2738 from 26.5 cows. Five farms each sold less than \$500 worth of milk.

On the valley farms an average of 14.7 cows were kept on 153 acres, of which 51 acres were pastured. The largest valley farm comprised 800 acres and kept thirty cows and thirty-one heifers. On this farm were 250 acres of hill pasture and a still larger acreage of woods, not pastured. Since the valleys are usually narrow, many farms classified in this study as valley farms have some steep hillside in pasture or in woods. Any farm that had bottom land in one of the three valleys mentioned was called a valley farm.

Seven valley farms kept less than eight cows, the smallest number being 6.5. More than twenty cows were kept on each of eleven farms. These farms comprised from 125 to 800 acres. The largest herd was thirty-seven cows, from which 2661 hundredweight of milk was sold for \$4889. This was the highest return from milk on any farm. There were three herds with thirty or more cows.

An average of 775 hundredweight of milk, returning \$1299, was sold from the valley farms. Seven valley farms received less than \$500 per farm from milk sold. With one exception these were small farms of from 40 to 80 acres. Some of them grew light truck crops for local markets; others depended almost exclusively on the dairy for their income.

Altho the enterprise is larger on the valley farms than on the hill farms, because more cows are kept on the former, the facts that on valley farms a greater proportion of the milk was produced during winter when milk prices are higher, and that cows on these farms are more heavily fed than are cows on the hill farms, largely account for the greater returns from the valley dairies.

Season of production

Most of the hill farms follow the summer system. While some valley herds are primarily summer dairies, in general they follow a more intensive system. This is influenced largely by the amount of crop work done, the distance to market, the growing season, and the productivity of the soil. On the average, the 99 hill farms produced during May, June, and July 36 per cent of their total pounds of milk sold for the year. This figure for the 50 valley farms was 31 per cent.

The per cent of the total pounds produced during November, December, January, and February, was 25 for the hill farms and 29 for the valley farms. Receipts from milk sold differed even more.

Production

The production per cow is better on the valley farms, especially in the larger herds. Since, as has been shown, the tendency is to produce more milk in winter and to feed heavier in the valleys, this is to be expected. On the average, 4994 pounds were sold per cow on the hills and 5260 pounds in the valleys, or about 266 pounds more per cow on the valley farms. For every dollar's worth of feed consumed, the milk sold from the

hills exceeded that from the valleys by ten pounds per cow. Hence, cows on hill farms are as good producers as those in the valleys, especially when relative values are considered. Particularly in the larger herds, the returns per cow from milk sold are greater in the valleys. Some of this is due to heavier yields, but more is due to the higher prices that prevail in winter. On hill farms the average receipts per cow from milk sold varied from \$41 to \$129, the average being \$81; and on the valley farms the highest receipts from milk sold were \$157 per cow, the lowest were \$44, and the average was \$88.

Comparisons of hill and valley farms in relation to various factors are shown in tables 110 to 112.

TABLE 110. COMPARISON OF HILL AND VALLEY DAIRIES AS TO INTENSITY OF FEEDING

	Number of cows per farm							
	Under 12		12-18		Over 18		Average	
	Hill	Valley	Hill	Valley	Hill	Valley	Hill	Valley
Pounds of grain fed per cow:								
Summer.....	99	78	163	53	155	198	144	124
Winter.....	1,261	1,208	1,172	1,516	1,248	1,372	1,216	1,368
Pounds of silage fed per cow.....	2,980	1,912	2,982	2,355	3,765	8,258	3,188	4,858
Pounds of other succulent feed per cow.....	570	1,259	788	545	927	587	770	1,020
Pounds of dry forage per cow.....	4,429	4,947	4,322	4,731	3,281	3,666	4,076	4,316
Per cent of farms feeding:								
Less than 1000 pounds of grain per cow.....	20	30	28	14	19	23	23	24
From 1000 to 1500 pounds of grain per cow.....	48	35	37	43	31	23	40	34
More than 1500 pounds of grain per cow.....	32	35	35	43	50	54	36	42
Profit or loss per cow when:								
Less than 1000 pounds were fed per cow.....	-\$4	+\$3	-\$10	+\$5	+\$11	+\$7	-\$4	+\$5
From 1000 to 1500 pounds were fed per cow.....	-\$10	-\$8	-\$2	-\$4	+\$15	+\$5	-\$1	-\$3
More than 1500 pounds were fed per cow.....	-\$13	-\$21	-\$4	-\$2	+\$1	+\$1	-\$5	-\$6
Per cent feeding silage.....	40	26	49	43	62	77	47	44

TABLE 111. COMPARISON OF HILL AND VALLEY DAIRIES AS TO COST OF PRODUCING MILK AND AS TO PROFIT OR LOSS ON CATTLE

	Number of cows per farm							
	Under 12		12-18		Over 18		Average	
	Hill	Valley	Hill	Valley	Hill	Valley	Hill	Valley
Herd cost per hundred pounds of milk.....	\$ 1.81	\$ 1.93	\$ 1.71	\$ 1.88	\$ 1.45	\$ 1.63	\$ 1.67	\$ 1.77
Cow cost per hundred pounds of milk.....	1.80	1.88	1.71	1.82	1.48	1.60	1.67	1.72
Price received per hundred pounds of milk sold.....	1.61	1.67	1.61	1.65	1.62	1.70	1.62	1.68
Profit or loss on cows per farm.....	-86	-86	-71	-126	+162	+145	-40	-37
Total costs per cow.....	110	109	103	109	94	113	102	111
Total returns per cow.....	100	99	98	100	101	119	99	108
Profit or loss on cows per cow.....	-10	-10	-5	-9	+7	+6	-3	-3
Profit or loss on cattle per farm.....	-91	-107	-66	-170	+198	+93	-33	-73

Cattle on the valley farms are given higher values than are cattle on the hill farms. This may be because the cows are larger, are better producers, are nearer the market, freshen in the fall, or are not kept in the herd so long. The average value of cows on the hill farms was \$63 a head, and of heifers \$22 a head. On the valley farms the value of cows was \$68, and of heifers \$26, a head. The average value at time of freshening of heifers that dropped their first calf during the year was \$56 for the hill farms and \$57 for the valley farms.

In all, 39 herds used purebred bulls. Of these, 22 were on hill farms and 17 were on valley farms. The proportion of farms using purebred bulls is greater in the valleys, and particularly so in the larger herds. Of the hill farms 22 per cent, and of the valley farms 34 per cent, used purebred bulls. Cows are replaced more frequently in the valley herds.

TABLE 112. COMPARISON OF HILL AND VALLEY DAIRIES AS TO MISCELLANEOUS FACTORS

	Number of cows per farm							
	Under 12		12-18		Over 18		Average	
	Hill	Valley	Hill	Valley	Hill	Valley	Hill	Valley
Cost of hauling milk per hundred-weight.....	\$0.26	\$0.16	\$0.25	\$0.11	\$0.14	\$0.12	\$0.22	\$0.13
Building investment per cattle unit.....	\$58	\$57	\$56	\$49	\$46	\$58	\$54	\$55
Building costs per cow.....	\$6	\$7	\$5	\$5	\$5	\$6	\$5	\$6
Average years cow remains in herd.....	7.8	7.8	7.5	6.8	6.9	7.5	7.5	7.4
Number of farms using pure-bred bulls.....	7	2	9	6	6	9	22	17
Per cent of farms using purebred bulls.....	18	9	21	43	38	69	22	34
Value of cows per head.....	\$64	\$65	\$62	\$65	\$64	\$72	\$63	\$68
Value of heifers per head.....	\$19	\$22	\$22	\$23	\$27	\$30	\$22	\$26
Value of heifers that became cows, per head.....	\$55	\$55	\$55	\$47	\$63	\$62	\$56	\$57
Number of heifers that became cows, per 100 cows.....	15.6	17.9	12.0	14.9	12.3	19.5	13.1	17.8

The primary purpose in comparing hill and valley farms is to emphasize the effect of location on practices. Conditions on the uplands, such as poor soil, higher elevation, rougher topography, and the longer distance to market, do not allow so intensive a system to be profitably conducted as is possible in the valleys. Whenever recommendations are made to farmers, or before one decides to locate in a section of so diverse characteristics, these fundamental facts should be given due consideration. They materially affect the system of farming.

Cow-testing-association herds

In 20 of the 149 herds, containing 394 cows, cow-testing-association work was being done by the Susquehanna Valley and Killawog cow testing associations. Most of these herds were on valley farms. With 19.7 cows to the farm, they were about half as large again as the average herd.

The average quantity of grain fed in these 20 herds was 1485 pounds per cow, of silage 6194 pounds, of other succulent feed 1070 pounds, and of dry forage 4034 pounds (table 113). Altho but 78 pounds of grain more than the average was fed, the quantity of silage used was nearly double

TABLE 113. AMOUNTS OF FEED USED, LABOR REQUIRED, AND OTHER QUANTITIES, FOR 394 COWS IN 20 COW-TESTING-ASSOCIATION HERDS

	Amounts		
	Total	Per cow	Per 100 pounds of milk produced
Number of farms.....	20	.....	.....
Number of cows.....	394	.....	.....
Number of heifers.....	240	.....	.....
Value of cows.....	\$26,183	\$66.45	.....
Value of heifers.....	\$6,925	\$28.85	.....
Grain fed.....	5,850 cwt.	1,485 pounds	25.6 pounds
Silage fed.....	1,220.2 tons	6,194 pounds	107.0 pounds
Other succulent feed.....	210.7 tons	1,070 pounds	18.5 pounds
Dry forage fed.....	794.67 tons	4,034 pounds	69.7 pounds
Human labor (except hauling milk).....	63,638 hours	162 hours	2.79 hours
Milk sold.....	21,324 cwt.	5,412 pounds	.....
Milk produced.....	22,804 cwt.	5,788 pounds	.....
Purebred bulls.....	16	.....	.....
Per cent of farms using purebred bulls.....	80	.....	.....

the average. The value of feed used per cow was \$63.80, as compared with the average of \$56.10 (table 114). Thus, in general, the feeding was heavier. The average time spent was 162 hours per cow. This is fifteen hours more per cow than for the nearest-sized group. The cows had an average valuation of \$66 a head and produced 5788 pounds of milk, of which 5412 pounds were sold. This yield is 256 pounds more than the average for all cows in the study. Of the 20 herds, 80 per cent used purebred bulls.

The costs per cow averaged \$109.46 for the herds in the associations. This is about \$6 per cow more than the average for all herds. The costs other than feed, however, were about \$1 less per cow than for the average herd.

The returns in association herds were \$106.67 per cow, or about \$6 more than the average. The loss was \$2.79 per cow, or about the same as the average.

The herd cost of milk for the twenty herds was \$1.74 per hundredweight and the cow cost \$1.71 per hundredweight, or 4 cents and 2 cents, respectively, higher than the average cost of milk production, but 10 cents less than the cost in winter dairies.

TABLE 114. COSTS AND RETURNS FOR 394 COWS IN 20 COW-TESTING-ASSOCIATION HERDS

Items	Value	
	Total	Per cow
Costs:		
Grain.....	\$9,030.00	\$22.92
Silage.....	6,103.00	15.49
Other succulent feed.....	698.00	1.77
Dry forage.....	7,591.00	19.27
Pasture.....	1,714.00	4.35
Bedding.....	291.00	0.74
Human labor.....	9,225.35	23.41
Horse labor.....	364.50	0.93
Use of buildings.....	1,723.28	4.37
Use of equipment.....	158.90	0.40
Interest on stock.....	1,309.15	3.32
Interest on feed.....	333.00	0.85
Bull service.....	488.84	1.24
Miscellaneous items.....	798.00	2.03
Hauling milk.....	3,299.17	8.37
Total costs.....	\$43,127.19	\$109.46
Returns:		
Milk sold.....	\$35,319.60	\$89.64
Milk and its products used.....	2,406.33	6.11
Increase on cows*.....	312.00	0.79
Manure.....	3,991.74	10.13
Total returns.....	\$42,029.67	\$106.67
Loss.....	\$1,097.52	\$2.79
Herd cost of milk.....	\$37,020.04	\$1.74 per cwt.
Cow cost of milk.....	\$36,417.12	\$1.71 per cwt.

*Value of calves at birth above depreciation on cows.

A still better comparison is to contrast the averages for these herds with the figures for all herds containing more than 18 cows and averaging 23.3 cows. The most striking points brought out by such a comparison are that the costs other than for feed for the cow-testing-association herds, and the returns, were approximately the same as for the nearest-sized group. But the association herds used feed valued at \$9 more per cow and the production was 65 pounds less per cow. There was a loss of \$3 per cow in association herds, while the average gain for herds with more than 18 cows was \$7 per cow.

The facts that in association herds the cows were held at a higher price, that production was better, that better bulls were used, and that the feeding was heavier, show that a more intensive system of dairying than the average was followed with these herds. In organizing an association, especial effort is made to induce dairymen with the larger herds to join, in order to finance the undertaking. Hence the mere fact that these dairy-

men joined associations is evidence that they were using unusual methods or had herds larger than common. This is probably true of most herds doing cow-testing-association work elsewhere in the State. Thus, results from cow-testing-association work should not be taken as an indication of the average cost of milk production for any region.

Milk hauling

Two important factors affecting the cost of delivering milk to the station are the method of hauling, and the distance to the station. Common ways of getting milk from the farm to the station are for dairy-men (1) to haul their own milk only, (2) to cooperate with one or more neighbors in hauling, (3) to hire their milk hauled, or (4) to use a combination of these methods. The number using each method is given in table 115, and data on the labor required and the cost of hauling by the different methods are given in tables 116 and 117.

TABLE 115. METHODS USED BY 149 DAIRYMEN IN DELIVERING MILK TO MARKET, AND NUMBER USING EACH METHOD

Method	Number using
Hauling.....	44
Cooperating in hauling.....	15
Hiring milk hauled.....	62
Hauling part distance full time, hiring remainder.....	13
Hauling part distance full time, cooperating remainder.....	1
Hauling full distance part time, hiring remainder.....	8
Hauling full distance part time, cooperating remainder.....	2
Using three methods, full distance, part time each.....	1
Hiring full distance part time and cooperating full distance part time.....	2
Cooperating part distance thruout and hiring part distance thruout.....	1
	149

Hauling own milk only.—On the average, 356 trips with a load of 240 pounds of milk worth \$3.99 were made per farm by farmers who hauled their own milk thruout the season. The average distance from these farms to market was 1.8 miles. On six farms women made some of the trips, on four farms boys made some, and on two farms girls made some. In all cases men made at least half the trips. The average time spent was 1.7 human hours and 2.2 horse hours per trip. The average cost of hauling was 23 cents per hundredweight, or \$12.53 per cow. This charge represented 14 per cent of the money received for the milk, 11 per cent of the average cost of keeping a cow on these farms, or 13 per cent of the cost of producing and marketing the milk. As the distance hauled increased, the time spent per trip, and therefore the cost of hauling, also increased.

Cooperating in hauling.—Fifteen farmers cooperated with one or more of their neighbors in hauling their milk. Altho on the average these farmers

TABLE 116. LABOR REQUIRED IN HAULING MILK VARIOUS DISTANCES BY DIFFERENT METHODS

	Average distance hauled (miles)	Number of farms	Trips per farm	Human hours per trip	Horse hours per trip	Human hours per 100 pounds of milk sold	Horse hours per 100 pounds of milk sold	Farms using woman or child labor	Farms using man labor	Hundred-weight of own milk hauled per load
When dairymen hauled										
1 mile or less.....	0.8	15	352	1.1	1.6	0.44	0.65	3	15	2.4
1+ to 2+ miles.....	1.9	22	365	1.8	2.3	0.79	1.02	7	22	2.3
3 to 4+ miles.....	3.5	6	349	2.1	2.3	0.71	0.78	2	6	2.9
5 miles or more.....	5.0	1	245	5.0	10.0	1.84	3.68	0	1	2.7
Total.....	1.8	44	356	1.7	2.2	0.68	0.90	12	44	2.4
Average.....										
When dairymen cooperated in hauling										
1 mile or less.....	1.0	3	183	1.3	2.5	0.31	0.58	1	3	4.3
1+ to 2+ miles.....	2.0	4	180	2.4	4.8	0.50	1.00	.....	4	4.8
3 to 4+ miles.....	3.9	5	96	3.2	6.3	0.56	1.12	.....	5	5.6
5 miles or more.....	5.3	3	42	5.4	10.9	0.46	0.91	.....	3	11.9
Total.....		15	.....	.....	.....	.....	.....	1	15	.....
Average.....	3.1	.....	125	2.5	4.9	0.46	0.92	.....	.....	5.4
When dairymen hauled part of the way and hired remaining distance.....	0.8	13	365	0.8	1.1	0.53*	0.68*	2	12	1.6

* Farmers' own time only.

TABLE 117. COST OF HAULING MILK VARIOUS DISTANCES BY DIFFERENT METHODS

	Average distance hauled (miles)	Average distance hauled (miles)	Number of farms	Number of cows per farm	Pounds of milk sold per cow	Per cent of milk sold during May, June, and July	Cost of milk hauling		Cost of producing milk per 100 pounds of milk sold	Per cent of value of milk sold, represented by cost of milk hauling
							Per cow	Per 100 pounds of milk sold		
When dairymen hauled										
1 mile or less.....	0.8	.....	15	15.5	5,492	33	\$ 8.81	\$0.160	\$1.68	10
1 + to 2 + miles.....	1.9	.....	22	15.4	5,476	33	14.38	0.263	1.75	16
3 to 4 + miles.....	3.5	.....	6	18.2	5,590	37	11.51	0.206	1.64	12
5 miles or more.....	5.0	.....	1	10.5	4,930	49	33.41	0.830	2.26	53
Total.....	.....	.....	44	.....	.....	.....	.....	.....	.....	.....
Average.....	1.8	.....	.....	15.8	5,405	34	\$12.53	\$0.230	1.72	14
When dairymen cooperated in hauling										
1 mile or less.....	1.0	.....	3	17.3	4,550	31	\$ 5.97	\$0.131	\$1.52	8
1 + to 2 + miles.....	2.0	.....	4	15.4	5,593	25	12.56	0.225	1.72	13
3 to 4 + miles.....	3.9	.....	5	12.2	4,431	42	11.21	0.253	1.59	16
5 miles or more.....	5.3	.....	3	10.8	4,052	43	9.55	0.205	1.44	13
Total.....	.....	.....	15	.....	.....	.....	.....	.....	.....	.....
Average.....	3.1	.....	.....	13.8	4,842	34	\$10.03	\$0.207	\$1.60	13
When dairymen hired milk hauled										
1 mile or less.....	.....	0.9	4	15.0	5,043	33	\$2.57	\$0.031	\$1.63	3
1 + to 2 + miles.....	.....	2.0	6	11.2	4,666	34	3.61	0.065	1.81	4
3 to 4 + miles.....	.....	3.7	20	13.5	4,520	38	4.63	0.102	1.55	6
5 miles or more.....	.....	7.1	32	12.0	5,140	33	5.78	0.112	1.72	7
Total.....	.....	.....	62	.....	.....	.....	.....	.....	.....	.....
Average.....	.....	5.1	.....	12.6	4,877	35	\$4.89	\$0.100	\$1.66	6
When dairymen hauled part of the way and hired remaining distance.....										
.....	0.8	5.8	13	12.6	4,598	.....	\$12.83	\$0.279	\$1.86	17
.....	.....	.....	.....	Farmers' time.....	.....	.....	8.19	0.178	.....	.....
.....	.....	.....	.....	Cash paid.....	.....	.....	4.64	0.101	.....	.....

lived 1.3 miles farther from market, which required 0.8 hour of human time and 2.7 hours of horse time additional to make a trip, the fact that they made 231 less trips per farm and hauled larger loads permitted of more economical hauling. The number of dairymen working together increased as the distance hauled increased.

Hiring milk hauled.—Sixty-two farmers hired their milk hauled thruout. On the average, milk was sent 361 days an average distance of 5.1 miles, nearly three times as far as those hauling their own milk hauled it; while the average cost of hauling was only 10 cents per hundred pounds, or \$4.89 per cow, less than half as much.

Hauling milk part distance and hiring remaining distance thruout the season.—Of the various combinations of the three methods, the commonest was for the dairyman to haul his milk part of the way, to a platform, and then hire it hauled the remaining distance to the station. In many cases this short haul was necessitated because the farm was located on a cross-road back from the main highway. The average distance that thirteen dairymen who used this method hauled their milk was 0.8 mile, and the average distance they hired it hauled was 5.8 miles. The labor cost of hauling the 0.8 mile was 17.8 cents per hundred pounds, while the amount paid to have the milk hauled 5.8 miles was only 10 cents per hundred pounds. If these thirteen farms had been located on collecting routes or on main highways, nearly all the time spent in making short hauls to platforms would have been saved. At the rates charged, this amounted to \$1338, or about \$103 per farm. This is 5 per cent on \$2060 per farm or on \$16 per acre.

If, when the farmer hauls or cooperates in hauling his milk, man labor is worth 15 cents an hour, woman or child labor 10 cents an hour, and horse labor 15 cents an hour, the rates here used, then the cheapest method of marketing milk is to hire it drawn. Studies have shown the same to be true in other regions when some of the labor was charged at lower rates. The important reason for this is that, by hauling full loads, men may make wages hauling milk long distances for a reasonable charge. Time taken to get ready, to hitch, and to unhitch, time lost on the road, and time lost in waiting at the station, when this time is worth average wages, makes the cost of a special trip with the product of a single herd very expensive. This is especially true when the herds are small.

By cooperating, thereby reducing the number of trips, many farmers could keep their marketing costs more reasonable. For some an adjustment in the size of the business or in the system of farming, so as to provide more productive work especially between morning and night chores, would make it more economical for them to hire their milk hauled rather than to haul it themselves. This is particularly true for those farther from market. The ideal type of dairy farming would be one which kept men and horses

fully employed between milkings at productive work, and which allowed each district to hire its milk hauled.

PART III. CONCERNING HEIFERS

Near New York City, where purchased feed, hay, labor, and milk are usually higher in price, and in dairy sections of the State where more of the land is suited for crop growing, fewer heifers are raised. This is because heifers can be most cheaply raised in regions that have an abundance of cheap pasture land and cheap hay. Many of the herds supplying milk for Rochester and Niagara Falls markets, and some for the Buffalo market, are replaced almost entirely by purchase, as there is less pasture land in those sections. The southern-tier counties, of which Broome County is one, have an abundance of cheap pasture and receive less for milk than do counties nearer New York. Hay also sells for less. Hence, conditions for raising dairy cattle are more favorable there.

Of the 149 farms, 146 raised heifers. The other 3 replaced their herds entirely by purchase.

The costs and returns for heifers of different ages were not kept separate. Therefore the relative costs of heifers for the first and second years were not found.

On 25 farms, 54 heifer calves under one year were lost by death. The death rate was 10 per cent of the average number inventoried, or 7 per cent of the number started.

Six heifers one year old or older died during the year. This is 1.3 per cent of the average inventory. Including the hide of one heifer slaughtered on the farm, seven hides were sold from five farms for \$37. Of heifers of all ages, there were 244 more on hand at the end of the year than at the beginning. There were 125 more heifers sold than purchased. Together with the 304 heifers that came into milk, the net number of heifers for the year above those on hand and those purchased was 673, or 32.7 per hundred cows.

Amounts of feed used and labor required

The average number of heifers was 1002. Two heifers were considered one cattle unit. But since the number was averaged for each record from the inventory, the number of cattle units totals 502.7.

The average age at which heifers freshened was not found. The quantities used, the costs, and the returns are for all heifers on hand during the year. The figures per cattle unit may be considered the approximate cost of raising a heifer to two years of age.

The average amounts of feed and labor used are given in table 118.

Feed

The details as to amounts, cost, and number of farms using each of the different kinds of feed used by heifers are given in tables 1 to 3 (pages 280 to 284).

TABLE 118. AMOUNTS OF FEED USED, LABOR REQUIRED, AND OTHER QUANTITIES, FOR HEIFERS

	Total	Per cattle unit	Per head	Number of farms using
Number of farms.....	146	.....	.....	.....
Average number of heifers....	1,002	.....	.....	.....
Average cattle units of heifers..	502.7	.....	.....	.....
Pounds of whole milk.....	215,464	429	215	134
Pounds of skimmilk:				
Separated on farm.....	96,068	191	96	32
Purchased.....	37,375	74	37	21
Pounds of buttermilk.....	1,300	3	1	3
Pounds of grain.....	267,116	531	267	139
Silage.....	310.1 tons	*1,234 pounds	619	45
Other succulent feed.....	25.25 tons	100 pounds	50	11
Dry forage.....	806.1 tons	3,207 pounds	1,609	138
Days on pasture.....	17,818	†146	.....	122
Hours of human labor:				
Summer.....	4,696	9.3	4.7	75
Winter.....	23,038	45.8	23.0	142
Hours of horse labor.....	1,259	2.5	1.3	49
Average value of heifers.....	\$23,626	\$47.00	\$23.58	.....

* 302.5 heifers were fed silage. This is 1580 pounds each.

† Per farm pasturing.

Whole milk.— About 108 tons of whole milk was fed to heifers on 134 farms. This is an average of 429 pounds per cattle unit, or about 375 pounds per heifer under one year old on hand at the end of the year.

Skimmilk.— On 32 farms, 48 tons of skimmilk separated on the farms was fed to heifers. Twenty-one farms purchased 19 tons of skimmilk to feed to heifers. The average price paid was 17 cents per hundred pounds. All skimmilk averaged 232 pounds per heifer calf on hand at the end of the year.

Grain.— The average amount of grain used was 531 pounds per cattle unit of heifers, or 267 pounds per head. The amount of calf meal used per heifer under one year old on hand at the end of the year was 25 pounds.

Succulent feed.— Forty-five farms fed silage to heifers. The total amount fed, divided by the number of heifers on all farms, averaged 1234 pounds per cattle unit, or 619 pounds per head. The average for farms feeding silage was 3160 pounds per cattle unit, or 1580 pounds per head.

Small quantities of other succulent feeds were used on eleven farms.

Dry forage.— An average of 3207 pounds of dry forage per cattle unit, or 1609 pounds per head, was given to heifers.

Pasture.— In all, 122 farms pastured heifers at home. The average time pastured was 146 days per farm pasturing.

Labor

Most of the time spent in taking care of heifers is in winter. The average human hours were 55.1 per cattle unit, or 27.7 hours per head. The

cattle-unit figure represents about 71 per cent of the time spent per cow exclusive of milking. Of the labor on heifers, 45.8 hours were spent in winter and 9.3 hours in summer.

There is some horse labor in hauling feed and bedding, taking heifers to pasture, and buying and selling. This averaged 2.5 hours per cattle unit, or 1.3 hours per head.

Costs, returns, and profits

The gross cost per cattle unit of heifers was \$56.84 (table 119). This checks with \$56.63, the average value at time of freshening for heifers that calved for the first time, and illustrates how accurately farmers can estimate costs. The value of manure at \$1.25 a ton amounted to \$9.62 per cattle unit, and the appreciation on heifers \$43.54 per cattle unit. These returns lacked \$3.68 per cattle unit, or \$1.85 for each heifer kept, of equaling the charges. Feed represents a larger proportion of the cost of raising a heifer than of the cost of keeping a milch cow.

TABLE 119. AVERAGE COSTS AND RETURNS FOR 1002 HEIFERS

	Total	Per cattle unit	Per head	Per cent
Costs:				
Whole milk.....	\$3,517.77	\$ 7.00	\$3.51	12.3
Skimmilk:				
Farm.....	171.17	0.34	0.17	0.6
Purchased.....	64.00	0.13	0.07	0.2
Buttermilk.....	2.45	0.01	0.00	.....
Grain.....	4,390.00	8.73	4.38	15.4
Silage.....	1,548.00	3.08	1.55	5.4
Other succulent feed.....	152.00	0.30	0.15	0.5
Dry forage.....	8,146.00	16.20	8.13	28.5
Pasture.....	1,907.00	3.79	1.90	6.7
Bedding.....	292.00	0.58	0.29	1.0
Human labor.....	4,160.10	8.28	4.15	14.6
Horse labor.....	188.85	0.38	0.19	0.7
Use of buildings.....	2,143.21	4.26	2.14	7.5
Use of equipment.....	221.45	0.44	0.22	0.8
Interest on stock.....	1,181.30	2.35	1.18	4.1
Interest on feed and supplies.....	305.50	0.61	0.31	1.1
Miscellaneous.....	182.00	0.36	0.18	0.6
Total costs.....	\$28,572.80	\$56.84	\$28.52	100.0
Returns:				
Manure.....	\$ 4,837.65	\$ 9.62	\$ 4.83	18.1
Appreciation.....	21,887.00	43.54	21.84	81.9
Total returns.....	\$26,724.65	\$53.16	\$26.67	100.0
Difference (= loss).....	\$1,848.15	\$3.68	\$1.85	.....
Value at birth, plus purchases, less sales and hides.....	\$2,434.00	\$4.84	.....	.....
Cost of raising a heifer to two years old....	\$26,169.15	\$52.06	.....	.....

The cost of raising a heifer to two years old is the total cost, \$56.84, plus the value at birth, \$4.44 per cattle unit, plus heifer purchases, \$3.64, less heifer sales and hides, \$3.24, less manure, \$9.62 per cattle unit—a net cost of \$52.06 per head. Since some heifers die or are disposed of before freshening, the cost per head of those that freshen is higher.

Size of herd

The number of heifers kept is not always proportional to the number of cows, but the methods of feeding and taking care of heifers is perhaps influenced more by the number of cows than by the number of heifers kept.

Like cows, heifers are fed more intensively in the larger herds. More milk, more grain, more silage, and more dry forage was used by heifers on farms keeping more than eighteen cows than on farms keeping from six to ten cows. Heifers also had a higher valuation in the larger herds than in the smaller herds, a safe indication that they were better grown. It is probable that they make a better class of cows, because they come from better stock and are better grown than the heifers in small herds.

The relation of the number of heifers raised to the labor cost of raising them is shown in table 120:

TABLE 120. RELATION OF NUMBER OF HEIFERS RAISED TO LABOR COST OF RAISING

Number of heifers per farm	Number of farms	Cattle units of heifers per farm	Hours per cattle unit*	Cost of labor at various rates per hour				
				15 cents	20 cents	25 cents	30 cents	35 cents
4.7.....	53	2.3	69.2	\$10.38	\$13.84	\$17.30	\$20.76	\$24.22
11.5.....	28	5.8	47.7	7.16	9.54	11.92	14.31	16.70
Difference between groups..	.....	3.5	21.5	\$3.22	\$4.30	\$5.38	\$6.45	\$7.52

* Labor in raising a heifer to two years of age.

Heifers in three seasonal groups

The intensity of the methods used in feeding and taking care of heifers is closely correlated with the intensity of the methods used in handling the milking herd. That is, in summer dairies heifers receive less feed, particularly silage, than in winter dairies. But the amount of labor required is much the same, regardless of the proportion of milk produced in summer.

In the summer dairies, wheat by-products, ground oats and corn, and oats, made up 60 per cent of the concentrates fed heifers. In winter dairies these made up only 33 per cent of the concentrates, chiefly because more mixed feed, cornmeal, and gluten were used in these herds. The data are given in table 121:

TABLE 121. RELATION OF SEASON OF PRODUCTION TO CONCENTRATES USED BY HEIFERS

Kind of feed	Less than 33 per cent of milk sold during May, June, and July. Winter dairies, 54 farms, 210.3 heifer cattle units		More than 40 per cent of milk sold during May, June, and July. Summer dairies, 41 farms, 128.7 heifer cattle units	
	Pounds	Per cent	Pounds	Per cent
Cornmeal.....	13,480	11.0	5,405	9.4
Gluten.....	14,210	11.6	4,375	7.6
Hominy.....	500	0.4	3,075	5.4
Corn and oats.....	300	0.2	6,350	11.1
Whole oats.....	.....	.....	700	1.2
Ground oats.....	*5,264	4.3	5,790	10.1
Wheat bran.....	13,070	10.7	2,275	4.0
Wheat feed.....	19,445	15.8	16,220	28.3
Wheat middlings.....	1,940	1.6	3,775	6.6
Cottonseed meal.....	2,405	2.0	300	0.5
Oilmeal.....	2,820	2.3	1,450	2.5
Calf meal.....	6,752	5.5	3,410	6.0
Brewers' grains.....	590	0.5	210	0.4
Dried beet pulp.....	.....	.....	100	0.2
Other grains not by-products.....	2,370	1.9	310	0.5
Mixed feeds.....	39,465	32.2	3,560	6.2
Total†.....	122,611	100.0	57,305	100.0

* Including a small quantity of whole oats not recorded separately.

† Omitting salt.

In summer dairies a larger proportion of the roughage fed heifers was corn stover and oat straw than in winter dairies. The figures showing the roughages used are given in table 122:

TABLE 122. RELATION OF SEASON OF PRODUCTION TO ROUGHAGES USED BY HEIFERS

Kind of feed	Less than 33 per cent of milk sold during May, June, and July. Winter dairies, 54 farms, 210.3 heifer cattle units		More than 40 per cent of milk sold during May, June, and July. Summer dairies, 41 farms, 128.7 heifer cattle units	
	Tons	Per cent	Tons	Per cent
Succulent feeds:				
Corn silage.....	183.6	98.3	25.0	69.4
Green corn.....	2.5	1.3	1.0	2.8
Turnips.....	.....	.....	10.0	27.8
Mangels.....	0.5	0.3	.....	.....
Potatoes.....	0.2	0.1	.....	.....
Total.....	186.8	100.0	36.0	100.0

TABLE 122 (concluded)

Kind of feed	Less than 33 per cent of milk sold dur- ing May, June, and July. Winter dairies, 54 farms, 210.3 heifer cattle units		More than 40 per cent of milk sold during May, June, and July. Sum- mer dairies, 41 farms, 128.7 heifer cattle units	
	Tons	Per cent	Tons	Per cent
Dry forage:				
Alfalfa hay.....	3.0	0.8	.....	.....
Clover hay.....	12.0	3.2	.....	.....
Clover (second cut).....	1.5	0.4	2.0	1.0
Timothy hay.....	50.8	13.6	8.8	4.4
Mixed hay.....	277.6	74.2	158.2	79.5
Oat hay.....	2.5	0.7	5.0	2.5
Oat and pea hay.....	3.1	0.8	1.5	0.8
Millet.....	8.2	2.2	3.0	1.5
Oat straw fed.....	0.9	0.2	5.5	2.8
Corn stover.....	14.6	3.9	14.9	7.5
Total.....	374.2	100.0	198.9	100.0

Further data on the relation of season of milk production to various factors for heifers are given in table 123.

Practically every item of cost for heifers and every item of return is less in summer dairies than in herds following the winter system. The cost of raising a heifer to two years old in the winter dairies was \$57.83 and in the summer dairies was \$44.75. There was little difference, however, in the value at freshening. Probably those in winter herds freshened at an earlier age, so that the relative difference between cost up to the time of freshening and value may not be as much as the figures suggest.

Data showing the relation of production and season of production to costs and returns for heifers are given in tables 124 and 125.

The fact that the ratio of heifer calves to older heifers was higher in summer dairies suggested the possibility of a change in the relative cost of raising a heifer in the different season groups, if the younger heifers were considered the equivalent of one-fourth cattle unit each, and the older heifers one-half cattle unit each, instead of all as one-half cattle unit. But the relative costs per cattle unit are not changed noticeably by this method of calculation.

More heifers in proportion to cows were found in the small herds and in the summer dairies.

Production per cow, and costs and returns for heifers

No tabulation was made to show the detailed costs and returns for heifers in low- and high-producing herds, because production per cow is closely correlated with season of production.

TABLE 123. RELATION OF SEASON OF MILK PRODUCTION TO AMOUNTS OF FEED USED, LABOR REQUIRED, AND OTHER QUANTITIES, FOR HEIFERS

	Less than 33 per cent of milk sold during May, June, and July			From 33 to 40 per cent of milk sold during May, June, and July			More than 40 per cent of milk sold during May, June, and July		
	Total	Per cattle unit	Per head	Total	Per cattle unit	Per head	Total	Per cattle unit	Per head
Number of farms.....	54	.....	.....	51	.....	.....	41	.....	.....
Average number of heifers.....	420.5	.....	.....	335.0	.....	.....	256.5	.....	.....
Average cattle units of heifers.....	210.3	.....	.....	163.7	.....	.....	128.7	.....	.....
Pounds of whole milk.....	92,009	438	219	81,003	498	251	41,852	325	163
Pounds of skim milk:									
Separated on farm.....	31,450	150	75	36,120	221	111	28,498	221	111
Purchased.....	11,910	57	28	16,015	98	49	9,450	73	37
Pounds of buttermilk.....	1,000	5	2	.....	.....	.....	.....	.....	.....
Pounds of grain.....	123,808	589	294	86,003	525	265	57,305	300	2
Silage.....	183.6 tons	1,746 pounds	873 pounds	101.5 tons	1,220 pounds	625 pounds	25.0 tons	389 pounds	223
Other succulent feed.....	3.25 tons	31 pounds	15 pounds	11.0 tons	134 pounds	68 pounds	11.0 tons	171 pounds	195 pounds
Dry forage.....	374.15 tons	3,558 pounds	1,779 pounds	233.05 tons	2,847 pounds	1,434 pounds	108.93 tons	3,094 pounds	86 pounds
Days on pasture.....	7,016	*156	.....	5,564	*129	.....	5,238	*154	1,551 pounds
Hours of human labor:									
Summer.....	1,364	6.5	3.2	1,662	10.3	5.2	1,640	12.7	6.4
Winter.....	9,664	46.0	23.0	7,940	48.5	24.4	5,634	42.2	21.2
Hours of horse labor.....	636	3.0	1.5	375	2.3	1.2	248	1.0	1.0
Average value of heifers.....	\$10,943	\$52.04	\$26.02	\$7,351	\$44.91	\$22.62	\$5,332	\$41.43	\$20.79
Heifers that became cows.....	158	.....	.....	88	.....	.....	58	.....	.....
Average value at time of freshening.....	.....	.....	\$57.35	.....	.....	\$54.06	.....	.....	\$58.62

* Per farm pasturing.

TABLE 124. RELATION OF SEASON OF PRODUCTION TO COSTS AND RETURNS FOR HEIFERS

	Less than 33 per cent of milk sold during May, June, and July			From 33 to 40 per cent of milk sold during May, June, and July			More than 40 per cent of milk sold during May, June, and July		
	Total	Per cattle unit	Per head	Total	Per cattle unit	Per head	Total	Per cattle unit	Per head
Costs:									
Grain.....	\$2,016.00	\$ 9.59	\$ 4.79	\$1,400.00	\$ 8.61	\$ 4.33	\$ 965.00	\$ 7.50	\$3.76
Slage.....	917.00	4.36	2.18	596.00	3.00	1.56	125.00	0.97	0.49
Other succulent feed.....	9.00	0.04	0.02	98.00	0.48	0.24	65.00	0.51	0.25
Dry forage.....	3,900.00	18.54	9.27	2,383.00	14.51	7.33	1,803.00	14.48	7.26
Whole milk.....	1,561.61	7.43	3.72	1,306.89	7.98	4.02	649.27	5.04	2.53
Skimmilk:									
Separated on farm.....	49.03	0.23	0.12	67.37	0.41	0.21	54.77	0.43	0.21
Purchased.....	20.00	0.10	0.05	27.00	0.16	0.08	17.00	0.13	0.07
Buttermilk.....	1.70	0.01	.....	.....	.....	.....	0.75	0.01	.....
Pasture.....	936.00	4.43	2.23	538.00	3.29	1.66	433.00	3.36	1.69
Bedding.....	121.00	0.58	0.29	116.00	0.71	0.36	55.00	0.43	0.21
Human labor.....	1,654.20	7.87	3.93	1,444.80	8.82	4.45	1,061.10	8.24	4.14
Horse labor.....	95.40	0.45	0.23	56.25	0.34	0.17	37.20	0.29	0.15
Use of buildings.....	1,041.36	4.95	2.48	659.89	4.03	2.03	441.06	3.43	1.72
Use of equipment.....	92.59	0.44	0.22	81.10	0.50	0.25	47.85	0.37	0.19
Interest on stock.....	547.15	2.60	1.30	307.55	2.25	1.13	266.60	2.07	1.04
Interest on feed and supplies.....	144.00	0.68	0.34	90.00	0.60	0.30	62.50	0.49	0.24
Miscellaneous.....	70.00	0.36	0.18	85.00	0.52	0.26	21.00	0.16	0.08
Total costs.....	\$13,181.95	\$62.68	\$31.35	\$9,224.85	\$56.35	\$28.38	\$6,166.00	\$47.91	\$24.03
Returns:									
Manure.....	\$2,115.25	\$10.06	\$ 5.03	\$1,577.30	\$ 9.64	\$ 4.85	\$1,145.10	\$ 8.90	\$4.46
Appreciation.....	9,402.00	45.13	22.57	7,231.00	44.17	22.25	5,164.00	40.12	20.14
Total returns.....	\$11,607.25	\$55.19	\$27.60	\$8,808.30	\$53.81	\$27.10	\$6,309.10	\$49.02	\$24.60
Difference (= profit or loss).....	—\$1,574.70	—\$7.49	—\$3.75	—\$416.55	—\$2.54	—\$1.28	—\$143.10	—\$1.11	—\$0.57
Value at birth, plus purchases, less sales and hides.....	\$1,095.00	\$5.21	.....	\$600.00	\$3.67	.....	\$739.00	.....	.....
Cost of raising a heifer to two years old.....	\$12,161.70	\$57.83	.....	\$8,247.55	\$50.38	.....	\$5,759.90	\$44.75	.....

Per cattle unit

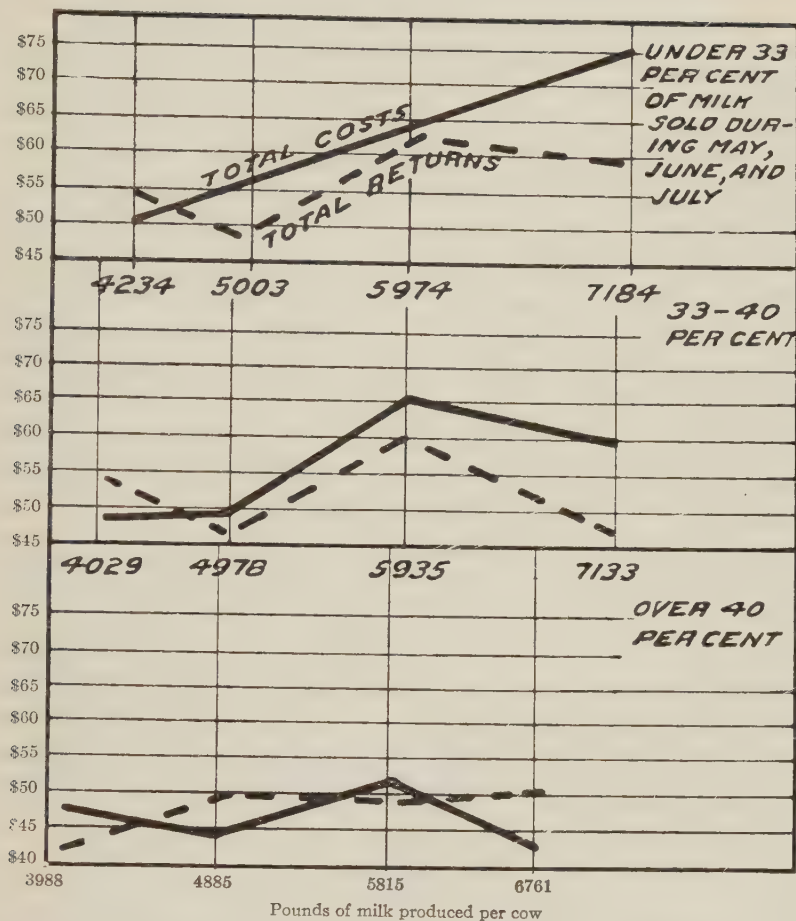


FIG. 69. RELATION OF PRODUCTION PER COW AND SEASON OF PRODUCTION TO COSTS AND RETURNS FOR HEIFERS

The difference in the cost of raising heifers in low-producing and in high-producing herds was greater in winter dairies than in summer dairies

Almost without exception the cost of raising heifers in high-producing herds is greater than in low-producing herds. The difference is greater in winter dairies than in summer dairies. The least cost per heifer was in the lower-producing summer dairies, and the highest cost per heifer was in the higher-producing winter dairies.

Probable cost at 1920 prices

Feed, labor, and other costs advanced from 1915 to 1920, and therefore the cost of raising a cow in 1920 was much higher than in 1915. An attempt has been made to estimate the probable cost in 1920 by applying approxi-

mate prices for that year to the quantities found in this investigation. In table 126 this cost is given for winter dairies, and in table 127 for summer dairies.

TABLE 125. RELATION OF PRODUCTION AND SEASON OF PRODUCTION PER COW TO COSTS AND RETURNS FOR HEIFERS

Per cent of milk sold during May, June, and July	Pounds of milk produced per cow			
	Under 4500	4501-5500	5501-6500	Over 6500
Less than 33 per cent:				
Cost per cattle unit.....	\$50	\$56	\$64	\$76
Returns per cattle unit.....	54	48	62	60
Gain or loss.....	+ 4	- 8	- 2	- 16
From 33 to 40 per cent:				
Cost per cattle unit.....	\$49	\$49	\$66	\$61
Returns per cattle unit.....	54	47	61	49
Gain or loss.....	+ 5	- 2	- 5	- 12
More than 40 per cent:				
Cost per cattle unit.....	\$47	\$45	\$53	*\$43
Returns per cattle unit.....	42	50	51	52
Gain or loss.....	- 5	+ 5	- 2	+ 9
Average:				
Cost per cattle unit.....	\$49	\$51	\$61	\$71
Returns per cattle unit.....	51	48	58	58
Gain or loss.....	+ 2	- 3	- 3	- 13
Value of heifers that became cows.....	52	56	58	59

* Only two farms in this group.

TABLE 126. PROBABLE 1920 COST OF RAISING A HEIFER TO TWO YEARS OF AGE IN WINTER DAIRIES, BROOME COUNTY

(Less than 33 per cent of milk sold in May, June, and July, 54 farms, 208 heifers under one year, 212 heifers one year old or over, 210.3 cattle units of heifers)

	Average per cattle unit	Price in 1914-15	Actual cost per cattle unit in 1914-15	Estimated 1920 price	Estimated cost per cattle unit at 1920 prices
Whole milk.....	438 pounds.	\$ 1.70	\$ 7.43	\$ 3.57	\$15.64
Skimmilk.....	212 pounds.	0.16	0.34	0.80	1.70
Grain.....	580 pounds.	32.66	9.59	60.00	17.67
Silage.....	1,746 pounds.	5.00	4.36	7.00	6.11
Other succulent feed.....	31 pounds.	2.58	0.04	5.00	0.08
Hay.....	3,411 pounds.	10.54	17.97	20.00	34.11
Other dry forage.....	147 pounds.	7.76	0.57	10.00	0.74
Human labor.....	52.5 hours..	0.15	7.87	0.35	18.38
Feed and labor.....					
Per cent of total cost.....			\$48.17		\$94.43
Total cost for two years.....			83.3		
Value of heifers that became cows.....			\$57.83*		\$113.36
			\$57.34		

* The total cost of keeping a heifer for two years equals the value at birth of heifers born during the year, plus the cost of heifers purchased, plus other heifer costs, less receipts for heifers and heifer hides sold, less value of manure, divided by the number of cattle units of heifers.

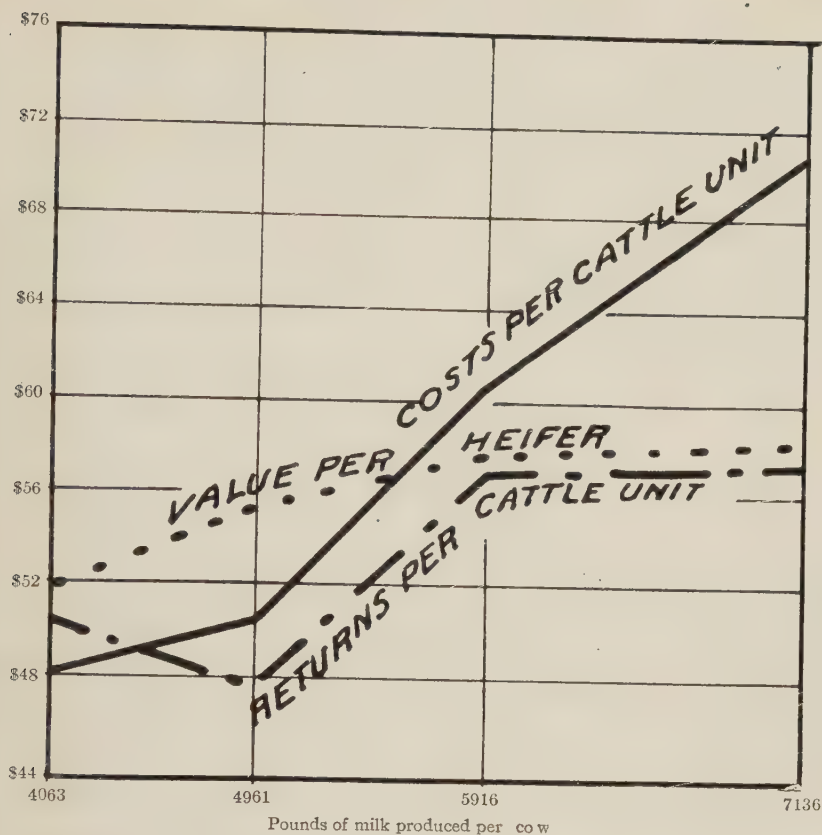


FIG. 70. RELATION OF PRODUCTION PER COW TO COSTS AND RETURNS PER CATTLE UNIT OF HEIFERS

TABLE 127. PROBABLE 1920 COST OF RAISING A HEIFER TO TWO YEARS OF AGE IN SUMMER DAIRIES, BROOME COUNTY

(More than 40 per cent of milk sold in May, June, and July, 41 farms, 144 heifers under one year, 113 heifers one year old or over, 128.7 cattle units of heifers)

	Average per cattle unit	Price in 1914-15	Actual cost per cattle unit in 1914-15	Esti- mated 1920 price	Estimated cost per cattle unit at 1920 prices
Whole milk.....	325 pounds	\$ 1.55	\$ 5.04	\$ 3.25	\$10.56
Skim milk.....	296 pounds	0.19	0.57	0.80	2.37
Grain.....	445 pounds	33.71	7.50	60.00	13.35
Silage.....	389 pounds	5.00	0.97	7.00	1.36
Other succulent feed.....	171 pounds	2.98	0.51	5.00	0.43
Hay.....	2,776 pounds	9.94	13.80	20.00	27.76
Other dry forage.....	316 pounds	4.30	0.68	10.00	1.58
Human labor.....	54.9 hours	0.15	8.24	0.35	19.22
Feed and labor.....			\$37.31		\$76.63
Per cent of total cost.....			83.4		
Total cost for two years.....			\$44.75		\$91.88
Value of heifers that became cows.....			\$58.62		

Results for first and second years from other sources

The quantities of feed used in raising a limited number of heifers the first and second years have been reported. These are given in table 128. If estimated 1920 prices in New York are applied to these quantities, as previously to the Broome County quantities, the results are as given in table 129.

One cannot absolutely precalculate costs, first, because of the uncertainty of choosing correct prices to apply to quantities, and secondly, because of the fact that changes in prices cause changes in practice.

TABLE 128. QUANTITIES OF FEED USED IN RAISING HEIFERS, FIRST AND SECOND YEARS. VARIOUS INVESTIGATIONS

	Wisconsin farm ¹	Ohio experiment station ²	Ohio experiment station ³	12 Ohio farms ⁴	Connecticut experiment station ⁵	Average
	Jersey	Jersey	Holstein		Holstein, Jersey, Guernsey	
First year:						
Number of heifers.....	20	40	29	.....	5	.....
Whole milk (pounds).....	342	405	499	510	445	452
Skimmilk (pounds).....	3,165	2,928	2,786	1,860	2,953	2,738
Grain (pounds).....	547	597	656	378	303	496
Silage (pounds).....	353	458	586	851	1,244	698
Hay (pounds).....	857	709	768	806	918	812
Corn stover (pounds).....	.....	40	29	348	.....	83
Pasture (days).....	123	122	128	122	?	?
Second year:						
Number of heifers.....	17	29	22	.....	5	.....
Skimmilk (pounds).....	.....	87	174	72	.....	67
Grain (pounds).....	.....	785	870	279	434	474
Silage (pounds).....	3,250	2,426	2,247	3,422	1,693	2,608
Hay (pounds).....	1,120	1,038	1,419	1,308	2,227	1,422
Corn stover (pounds).....	672	254	232	652	.....	362
Pasture (days).....	171	159	151	176	168	165
Weight at birth (pounds).....	.....	56	82	.....	.....	.....
Weight at one year (pounds).....	.....	472	571	.....	.....	.....
Weight at two years (pounds).....	.....	758	962	.....	.....	.....

¹ United States Agricultural Department, Bul. 49, pages 6 and 10.

² Ohio Agricultural Experiment Station, Bul. 289, pages 9-10.

³ Ohio Agricultural Experiment Station, Bul. 289, pages 13-14.

⁴ Ohio Agricultural Experiment Station, Monthly Bul., vol. 2, no. 9, page 292.

⁵ Storrs Agricultural Experiment Station, Bul. 63.

TABLE 129. PROBABLE 1920 COST FOR FIRST AND SECOND YEARS. VARIOUS INVESTIGATIONS

	Average per heifer (pounds)	Estimated 1920 price	Cost at estimated 1920 prices
First year:			
Whole milk.....	452	\$ 3.57	\$16.14
Skimmilk.....	2,738	0.80	21.90
Grain.....	496	60.00	14.88
Silage.....	698	7.00	2.44
Hay.....	812	20.00	8.12
Corn stover.....	83	10.00	0.42
Barn feed first year.....			\$63.90

TABLE 129 (concluded)

	Average per heifer (pounds)	Estimated 1920 price	Cost at estimated 1920 prices
Second year:			
Skimmilk.....	67	\$ 0.80	\$ 0.54
Grain.....	474	60.00	14.22
Silage.....	2,608	7.00	9.13
Hay.....	1,422	20.00	14.22
Corn stover.....	362	10.00	1.81
Barn feed second year.....			\$39.92
Total for two years.....			\$103.82
Labor (Broome County winter dairies), 52.5 hours at 35 cents.....			\$18.38
Assuming feed and labor at 83.3 per cent (Broome County winter dairies), total cost for two years.....			\$146.70

PART IV. CONCERNING HERD BULLS

On 17 farms no herd bulls were owned. Of these 17, 4 pastured bulls in return for their use, 7 hired bull service, and 6 received the use of a bull free. The remaining 132 farms used their own bulls. On these farms the common practice was to raise a bull calf to be used for one or two years and then sold for slaughter. In some cases this was a purchased calf, but too often it was a grade calf from the farmer's own herd.

Bull calves to be kept

About 40 per cent of the farms reported calves on hand to be kept for herd bulls. The average number was 67, valued at \$1074, or \$16.03 a head. During the year 24 were purchased to be raised, for \$752, an average price of \$31.33 a head. On 50 farms, 54 of the bull calves born during the year were kept for future use. Their average value at birth was \$4.19. Two were slaughtered or sold for slaughter at an average price of \$20, and two died.

Herd bulls from one to two years old

The average number of bulls on hand from one to two years old was 60, valued at \$2162, or \$36.15 a head. During the year there were 20.5 bulls of this age purchased for \$35.07 each, 25.5 slaughtered or sold for slaughter at \$38.82 each, 7 sold to be used in other herds at \$44 each, and one that died.

Herd bulls more than two years old

A lesser number of older herd bulls were kept. The average number more than two years old was 45, valued at \$3102, or about \$68.93 a head. During the year 10.5 bulls more than two years old were purchased at \$43.62 each, 30 were slaughtered or sold for slaughter at \$56.56 each, and 7 were sold to be used in other herds at an average price of \$81.86 each.

Bulls of this age are commoner in the larger herds. Of all bulls more than one year old sold, less than one-fourth went for service in other herds.

On the 132 farms there was an average number of 171.7 herd bulls, representing 109.1 cattle units. In calculating the cattle units of herd bulls, those more than two years old were considered as one cattle unit and all under this age as one-half cattle unit.

Feed used

The amounts and kinds of feed used by bulls have been given in tables 1 to 3 (pages 280 to 284).

Whole milk.—On 65 farms, 26,275 pounds of whole milk were fed to 67 bull calves to be kept. This is an average of 392 pounds per calf. From 200 to 600 pounds was the usual amount fed, depending largely on the price of milk at the time the calf was started, the amount of skimmilk available, whether or not the calf was purebred, and other factors. When feeding was heavier, rarely did the increased value of the calf equal the value of the milk used. In one grade herd, a purebred Holstein calf valued at \$20 at birth was fed whole milk for twelve weeks—a total of 1820 pounds, which would have sold for \$33.31, being used. This calf used also 100 pounds of calf meal, costing \$3, and a small quantity of hay. At the end of the period he was valued at \$50. Seldom does it pay to feed as much milk as this to a bull calf. Bull calves started largely on milk substitutes develop bone and frame, and, if fed equally well later, usually make as satisfactory animals as do calves fed heavily on whole milk, and at much less cost.

Skimmilk.—Eight farms had their own skimmilk, and five purchased skimmilk to feed to bulls to be kept. The average amount fed was about 636 pounds per calf using it, but the amount varied from 200 to nearly 2000 pounds. In some instances skimmilk was substituted for all of the whole milk except a few feeds. Where plenty of skimmilk is available at a reasonable price, the feeding of whole milk after the first week to bulls to be raised is too expensive.

Grain.—Of 132 farms keeping herd bulls, 108 fed the bulls grain. The average amount used was 533 pounds per cattle unit, or 339 pounds per head. Ten farms fed 1000 pounds or more per bull. It is questionable whether for bulls of this quality as much grain as 1000 pounds is good economy except in finishing a bull for the block.

On 21 farms, 1426 pounds of calf meal was fed to bulls to be kept. This is about 68 pounds per calf using meal.

Succulent feed.—On 39 farms, 78 tons of silage was fed to herd bulls. The amount varied from 0.5 ton to 4 tons per farm. The average quantity used was 1430 pounds per cattle unit, or 909 pounds per head. In no case was more than 4 tons given to a bull.

On 6 farms, small quantities of turnips, potatoes, and mangels were used. The average was 52 pounds per cattle unit, or 33 pounds per head.

Dry forage.—The larger proportion of the feed given to bulls is mixed hay and other dry forage. This varied from 0.1 ton to 5 tons per farm. The usual allowance was from 1 to 3 tons for a yearling or an older bull. If the roughage is of good quality, a bull will keep in good condition on little else. The average amount fed was 3430 pounds per cattle unit, or 2179 pounds per head.

Pasture.—On 100 farms, bulls were allowed to pasture with the cows an average of 131 days per farm. On the remaining 32 farms they were kept in the stable and the barnyard thruout the year, or tethered a part of the time on the meadows. The practice of pasturing is commoner in the summer dairies.

Often when it was not desired or was not possible to pasture the bull with the herd, practically full feed from shortly after the hay was cut till late in the fall was provided by staking him on a near-by meadow. This saved the expense for hay and the time spent in taking care of the bull in the stable, but necessitated the spending of extra time in providing water.

Usually the cheapest way of summering a bull is to allow him to pasture with the herd; the next cheapest is tethering him; and the most expensive is keeping him in the stable. A bull will make better gains in the field than in the barn during summer, and this is particularly important if he is about to be sold.

Labor

Since on most farms the bulls were pastured practically four-fifths of the pasture season, the labor required during the summer was negligible.

TABLE 130. AVERAGE AMOUNT OF FEED USED, LABOR REQUIRED, AND OTHER QUANTITIES, FOR 67 BULL CALVES TO BE KEPT, 59.7 HERD BULLS FROM ONE TO TWO YEARS OLD, AND 45 HERD BULLS MORE THAN TWO YEARS OLD

	Total*	Per cattle unit	Per head	Number of farms using
Number of farms.....	132	.....	.....	.....
Average number of herd bulls.....	171.7	.....	.....	.....
Average cattle units of herd bulls.....	109.1	.....	.....	.....
Pounds of whole milk.....	26,275	241	153	65
Pounds of skimmilk:				
Separated on farm.....	6,493	85	54	{ 8
Purchased.....	2,775			
Pounds of grain.....	58,203	533	339	108
Silage.....	78 tons	1,430 pounds	909	39
Other succulent feed.....	2.85 tons	52 pounds	33	6
Dry forage.....	187.1 tons	3,430 pounds	2,179	118
Days on pasture.....	13,139	†131	.....	100
Hours of human labor:				
Summer.....	1,145	10	7	35
Winter.....	6,852	63	40	120
Hours of horse labor.....	37	0.3	0.2	5
Average value of herd bulls.....	\$6,335	\$58.07	\$36.90	.....

*Given in previous tables.

†Per farm pasturing.

The time spent in summer averaged 10 hours per cattle unit, or about 7 hours per head, while that spent in winter averaged 63 hours per cattle unit, or 40 hours per head (table 130). The maximum time spent on herd bulls, on any farm, was 227 hours. The average total time was 73 hours per cattle unit, or a little more than a third of the time spent in taking care of a cow and handling her product.

All the returns from herd bulls averaged \$41.65 per cattle unit, or \$26.47 per head (table 131). On 35 of the 132 farms, the returns exceeded the cost of herd bulls.

TABLE 131. AVERAGE COSTS AND RETURNS FOR 67 BULL CALVES TO BE KEPT, 59.7 HERD BULLS FROM ONE TO TWO YEARS OLD, AND 45 HERD BULLS MORE THAN TWO YEARS OLD

	Total	Per cattle unit	Per head	Per cent
Number of bulls.....	171.7	.....	.....	.....
Number of cattle units.....	109.1	.....	.....	.....
Costs:				
Whole milk.....	\$ 429.47	\$ 3.94	\$ 2.50	6.8
Skimmilk.....	17.08	0.16	0.10	0.3
Grain.....	948.00	8.69	5.52	15.0
Silage.....	388.00	3.56	2.26	6.1
Other succulent feed.....	9.00	0.08	0.05	0.2
Dry forage.....	1,911.00	17.52	11.13	30.2
Pasture.....	346.00	3.17	2.01	5.5
Total feed.....	\$4,048.55	\$37.12	\$23.57	64.1
Bedding.....	115.00	1.05	0.67	1.8
Human labor.....	1,199.55	10.99	6.99	18.9
Horse labor.....	5.55	0.05	0.03	0.1
Use of buildings.....	464.46	4.26	2.71	7.3
Use of equipment.....	71.65	0.66	0.42	1.1
Interest on stock.....	316.75	2.90	1.84	5.0
Interest on feed and supplies.....	91.00	0.83	0.53	1.4
Miscellaneous.....	20.00	0.18	0.12	0.3
Total costs.....	\$6,332.51	\$58.04	\$36.88	100.0
Returns:				
Manure.....	\$1,063.21	\$ 9.75	\$ 6.19	23.4
Appreciation.....	3,339.00	30.60	19.45	73.5
Amount received for service.....	142.00	1.30	0.83	3.1
Total returns.....	\$4,544.21	\$41.65	\$26.47	100.0
Difference (= cost of keeping herd bulls)....	\$1,788.30	\$16.39	\$10.41	.....
Amount paid for service, 28 farms.....	\$183.00	\$1.68	\$1.07	.....
Total cost of bull service.....	\$1,971.30	\$18.07	\$11.48	.....

Cost of keeping herd bulls

The difference between the costs and returns was considered the cost of keeping herd bulls and was charged to cows. This averaged \$16.39 per cattle unit, or \$10.41 per head.

Cost of bull service on farms keeping herd bulls

In addition to the costs just given, \$125 was paid by 18 of the farms keeping herd bulls, for the use of other bulls. This makes the cost of bull service on farms keeping herd bulls \$1913.30, or 99 cents per cow.

Cost of bull service on farms hiring service only

On 7 other farms, keeping 65.5 cows, \$58 was paid for the use of bulls. The cost of bull service per cow for these farms was 82 cents, in addition to the time spent driving the cows.

Total cost of bull service

Thus, on 149 farms the cost of bull service was \$1971.30, or 96 cents per cow kept, including 6 farms that received the use of a bull free. The cost reached as high as \$5 per cow on some farms. On farms where the returns from herd bulls exceeded the cost, the excess was credited to cows.

Comparison of grade and purebred bulls

On 39 farms purebred bulls were kept. Of these, 30 used registered Holsteins, 6 used Holsteins eligible to registry, and 3 used registered Guernseys. On the remaining 93 farms, grade bulls were used.

Purebred bulls were fed more liberally and were given more care than were grades. Excepting pasture, horse labor, and skimmilk, every item of cost was higher for purebred bulls than for grades.

Comparative figures for grade and purebred bulls in relation to various factors are given in tables 132 to 136.

The fact that the costs are slightly less is no argument for using grade bulls. There are many farmers now using grade bulls who should have a purebred bull of one of the leading dairy breeds. The larger the herd and the more intensive the system, the more important this becomes. The damage resulting from the use of a poor bull is much greater in a large herd than in a small one.

Age of bull

The increased value of bull calves and of yearling bulls is more likely to exceed the cost of their keep than is the increased value of older bulls. Ordinarily, therefore, the practice of selling bulls after one or two years of use results in cheaper bull service or greater net returns from herd bulls than where they are kept longer. Under unusual conditions with purebred or high-grade animals this may not be true.

Of the 132 farms with herd bulls, there were 16 that kept grade bulls and 12 that kept purebred bulls, all one year old or older. There were also 56 other farms that kept grade bulls and 12 other farms that kept purebred bulls, all of which were less than two years old. The costs and returns for herd bulls on these farms illustrate the point made in the pre-

TABLE 132. FEED USED, LABOR REQUIRED, AND OTHER QUANTITIES FOR HERD BULLS

Items	Grades			Purebreds		
	Total	Per cattle unit	Per head	Total	Per cattle unit	Per head
Number of farms.....	93	.....	.....	39	.....	.....
Number of cows.....	1,240.5	.....	.....	647.5	.....	.....
Number of bulls.....	124.7	.....	.....	47.0	.....	.....
Cattle units of bulls.....	74.1	.....	.....	35.0	.....	.....
Value of bulls.....	\$3,180	\$42.91	\$25.50	\$3,155	\$90.14	\$67.13
Pounds of whole milk.....	18,083	244	145	8,192	234	174
Pounds of skim milk.....	8,500	115	68	768	22	16
Pounds of grain.....	35,955	485	288	22,248	636	473
Succulent feed.....	39.6 tons	1,069 pounds	635 pounds	41.25 tons	2,357 pounds	1,755 pounds
Dry forage.....	123.1 tons	3,323 pounds	1,974 pounds	64.0 tons	3,657 pounds	2,723 pounds
Human hours.....	5,344	72	43	2,653	76	56
Horse hours.....	37	0.5	0.3	.....	.....	.....

ceding paragraph. On many farms, bulls of all these ages were kept. In such cases the cost of keeping the older bulls was combined with the cost of raising the younger animals, and therefore these records are omitted from the tabulation.

TABLE 133. COSTS AND RETURNS FOR HERD BULLS

Items	Grades			Purebreds		
	Total	Per cattle unit	Per head	Total	Per cattle unit	Per head
Costs:						
Whole milk.....	\$ 292.37	\$ 3.95	\$2.34	\$137.10	\$ 3.92	\$ 2.92
Skim milk.....	15.41	0.21	0.12	1.67	0.05	0.03
Grain.....	595.00	8.03	4.77	353.00	10.09	7.51
Succulent feed.....	196.00	2.65	1.57	201.00	5.74	4.28
Dry forage.....	1,246.00	16.82	9.99	665.00	19.00	14.15
Pasture.....	265.00	3.58	2.13	81.00	2.31	1.72
Bedding.....	67.00	0.90	0.54	48.00	1.37	1.02
Human labor.....	801.60	10.81	6.43	397.95	11.37	8.47
Horse labor.....	4.80	0.06	0.04	0.75	0.02	0.02
Use of buildings.....	290.47	3.92	2.33	173.99	4.97	3.70
Use of equipment.....	45.35	0.61	0.36	26.30	0.75	0.56
Interest on stock.....	159.00	2.15	1.28	157.75	4.51	3.36
Interest on feed and supplies.....	55.50	0.75	0.45	35.50	1.01	0.75
Miscellaneous.....	4.00	0.05	0.03	16.00	0.46	0.34
Total costs.....	\$4,037.50	\$54.49	\$32.38	\$2,295.01	\$65.57	\$48.83
Returns:						
Manure.....	\$ 693.18	\$ 9.35	\$ 5.56	\$370.03	\$10.57	\$ 7.88
Appreciation.....	2,403.00	32.43	19.27	936.00	26.74	19.91
Amount received for service.....	34.00	0.46	0.27	108.00	3.09	2.30
Total returns.....	\$3,130.18	\$42.24	\$25.10	\$1,414.03	\$40.40	\$30.09
Difference (= cost of keeping herd bulls).....	\$907.32	\$12.25	\$7.28	\$880.98	\$25.17	\$18.74
Amount paid for service.....	\$153.00	\$2.00	\$1.23	\$30.00	.....	.....
Total cost of bull service.....	\$1,060.32	\$14.31	\$8.50	\$910.98	.....	.....
Cost of service per cow.....	\$0.85	.....	.....	\$1.41	.....	.....

The costs for older bulls, either grades or purebreds, are higher than for younger bulls. In addition the increased value is less. The net cost of keeping the older bulls, therefore, is very much greater, either per cattle unit or per head. This makes the cost of bull service higher. Generally speaking, the herds are too small, the system of dairying is too extensive, the value of the offspring and the price for the milk are too low, and the winter feed for old bulls is too expensive, to justify keeping a bull beyond the second year of service if it is a grade or a scrub. Naturally there may be exceptions when bulls are owned jointly in purebred herds or when other conditions may be unusual for the region.

One of the important ways of keeping down the charge for the use of a bull is to have a large herd. By having a large herd the services of a much better bull may be obtained at no greater cost per cow than would be occasioned by the use of a poorer bull in a small herd. This is important when a valuable purebred bull is required.

The proportion of larger herds using older bulls is higher than that of small ones. As in the case of heifers, this has some influence on relative costs for the different groups.

TABLE 134. FEED USED, LABOR REQUIRED, AND OTHER QUANTITIES FOR HERD BULLS ON FARMS KEEPING ONLY BULLS ONE YEAR OLD OR OLDER

	Grades			Purebreds		
	Total	Per cattle unit	Per head	Total	Per cattle unit	Per head
Number of farms.....	16	.....	.....	12	.....	.....
Number of cows.....	233.5	.....	.....	238.5	.....	.....
Number of bulls.....	12.5	.....	.....	11.0	.....	.....
Cattle units of bulls.....	10.1	.....	.....	10.5	.....	.....
Value of bulls.....	\$509	\$50.40	\$40.72	\$1,229	\$117.05	\$111.72
Pounds of grain.....	7,670	759	614	5,110	487	465
Succulent feed.....	11.35 tons	2,248 pounds	1,816 pounds	18.45 tons	3,514 pounds	3,355 pounds
Dry forage.....	20.10 tons	3,980 pounds	3,216 pounds	21.8 tons	4,152 pounds	3,964 pounds
Human labor (hours).....	926	91.7	74.1	812	77.3	73.8
Days pastured.....	1,769	*161	.....	1,547	*155	.....

*Per farm pasturing.

TABLE 135. COSTS AND RETURNS FOR HERD BULLS ON FARMS KEEPING ONLY BULLS ONE YEAR OLD OR OLDER

	Grades			Purebreds		
	Total	Per cattle unit	Per head	Total	Per cattle unit	Per head
Costs:						
Grain.....	\$113.00	\$11.19	\$ 9.04	\$ 77.00	\$ 7.33	\$ 7.00
Succulent feed.....	56.00	5.54	4.48	88.00	8.38	8.00
Dry forage.....	221.00	21.88	17.68	215.00	20.48	19.55
Pasture.....	52.00	5.15	4.16	28.00	2.67	2.55
Bedding.....	13.00	1.28	1.04	14.00	1.34	1.27
Human labor.....	138.90	13.75	11.11	121.80	11.60	11.07
Horse labor.....	1.80	0.18	0.14	.....	.....	.....
Use of buildings.....	44.61	4.42	3.57	46.20	4.40	4.20
Use of equipment.....	8.35	0.83	0.67	8.30	0.79	0.75
Interest on stock.....	25.45	2.52	2.04	61.45	5.85	5.59
Interest on feed and supplies.....	11.00	1.09	0.88	10.00	0.95	0.91
Miscellaneous.....	.....	.....	.....	4.00	0.38	0.36
Total costs.....	\$685.11	\$67.83	\$54.81	\$673.75	\$64.17	\$61.25
Returns:						
Manure.....	\$ 98.00	\$ 9.70	\$ 7.84	\$107.57	\$10.25	\$ 9.78
Appreciation.....	286.00	28.32	22.88	159.00	15.14	14.46
Amount received for service.....	16.00	1.58	1.28	80.00	7.62	7.27
Total returns.....	\$400.00	\$39.60	\$32.00	\$346.57	\$33.01	\$31.51
Difference (=cost of keeping herd bulls)	\$285.11	\$28.23	\$22.81	\$327.18	\$31.16	\$29.74
Breeding fees.....	\$2.00	\$0.20	\$0.16	\$20.00	\$1.90	\$1.82
Cost of bull service.....	\$287.11	\$28.43	\$22.97	\$347.18	\$33.06	\$31.56
Cost per cow.....	\$1.23	.....	.....	\$1.46	.....	.....

TABLE 136. COSTS AND RETURNS FOR HERD BULLS ON FARMS KEEPING ONLY BULLS LESS THAN TWO YEARS OLD

	Grades			Purebreds		
	Total	Per cattle unit	Per head	Total	Per cattle unit	Per head
Number of farms.....	56	.....	.....	12	.....	.....
Number of cows.....	691.0	.....	.....	154.0	.....	.....
Average number of herd bulls.....	78.2	.....	.....	11.0	.....	.....
Average cattle units of herd bulls.....	41.6	.....	.....	6.8	.....	.....
Value of bulls.....	\$1,683	\$40.46	\$21.52	\$475.00	\$69.85	\$43.18
Total costs.....	\$2,296.04	\$55.19	\$29.36	\$522.82	\$76.89	\$47.53
Appreciation.....	\$1,508.00	\$36.25	\$19.28	\$284.00	\$41.76	\$25.82
Total returns.....	\$1,902.48	\$45.73	\$24.33	\$369.06	\$54.27	\$33.55
Cost of keeping bulls.....	\$393.56	\$9.46	\$5.03	\$153.76	\$22.61	\$13.98
Amount paid for service.....	\$81.00	.....	.....	\$10.00	.....	.....
Cost of bull service.....	\$474.56	.....	.....	\$163.76	.....	.....
Cost of service per cow.....	\$0.69	.....	.....	\$1.06	.....	.....

More grain, silage, and dry forage, and less milk, are used by bulls in the larger herds. This is partly due to the fact that more of the bulls are older, and partly to more intensive feeding. Also, less labor is required in their care.

Cost of bulls in three seasonal groups

Not only the costs and returns from cows and from heifers, but also the costs and returns from herd bulls, are closely correlated with the intensity of dairy methods. Where an intensive system prevails, the tendency

TABLE 137. RELATION OF SEASON OF MILK PRODUCTION TO AMOUNTS OF FEED USED, LABOR REQUIRED, AND OTHER QUANTITIES FOR HERD BULLS

	Less than 33 per cent of milk sold during May, June, and July			From 33 to 40 per cent of milk sold during May, June, and July			More than 40 per cent of milk sold during May, June, and July		
	Total	Per cattle unit	Per head	Total	Per cattle unit	Per head	Total	Per cattle unit	Per head
Number of farms.....	48	.....	.....	44	.....	.....	40	.....	.....
Average number of herd bulls.....	57.4	.....	.....	59.3	.....	.....	55.0	.....	.....
Average cattle units of herd bulls.....	36.8	.....	.....	38.4	.....	.....	33.9	.....	.....
Pounds of whole milk.....	10,497	285	183	8,299	216	140	7,479	221	136
Pounds of skim milk:									
Separated on farm.....	2,000	54	35	1,780	46	30	2,713	80	49
Purchased.....	705	19	12	320	8	5	1,750	52	32
Pounds of grain.....	26,495	720	462	17,588	458	297	14,120	417	257
Other succulent feed.....	44 tons	2,391 pounds	1,533 pounds	25.85 tons	1,346 pounds	872 pounds	8.15 tons	481 pounds	296 pounds
Dry forage.....	0.5 ton	27 pounds	17 pounds	2.05 tons	107 pounds	69 pounds	0.3 ton	18 pounds	11 pounds
Days on pasture.....	74.75 tons	4,062 pounds	2,605 pounds	60.15 tons	3,133 pounds	2,029 pounds	52.2 tons	3,080 pounds	1,898 pounds
Hours of human labor:									
Summer.....	514	14.0	9.0	377	9.8	6.4	4,190	7.5	4.6
Winter.....	2,774	75.4	48.3	2,253	58.7	38.0	1,825	53.8	33.2
Average value of herd bulls.....	\$2,398	\$65	\$42	\$2,283	\$59	\$38	\$1,654	\$49	\$30
Per cent of bulls more than two years old.....	29.4	.....	.....	27.3	.....	.....	21.8	.....	.....
Per cent of bulls from one to two years old.....	31.2	.....	.....	37.2	.....	.....	36.4	.....	.....
Per cent of bull calves.....	39.4	.....	.....	35.5	.....	.....	41.8	.....	.....

* Per farm pasturing.

TABLE 138. RELATION OF SEASON OF MILK PRODUCTION TO COSTS AND RETURNS FOR HERD BULLS

	Less than 33 per cent of milk sold during May, June, and July			From 33 to 40 per cent of milk sold during May, June, and July			More than 40 per cent of milk sold during May, June, and July		
	Total	Per cattle unit	Per head	Total	Per cattle unit	Per head	Total	Per cattle unit	Per head
Costs:									
Grain.....	\$433.00	\$11.77	\$ 7.55	\$286.00	\$ 7.45	\$ 4.82	\$229.00	\$ 6.76	\$4.16
Silage.....	219.00	5.95	3.82	129.00	3.36	2.18	40.00	1.18	0.73
Other succulent feed.....	1.00	0.03	0.02	6.00	0.10	0.10	2.00	0.06	0.04
Dry forage.....	784.00	21.30	13.00	628.00	16.35	10.59	499.00	14.72	9.07
Whole milk.....	181.65	4.94	3.16	132.70	3.40	2.24	115.12	3.39	2.10
Skimmilk:									
Separated on farm.....	3.00	0.08	0.05	3.56	0.09	0.06	4.52	0.13	0.08
Purchased.....	2.00	0.05	0.03	1.00	0.03	0.02	3.00	0.09	0.05
Pasture.....	114.00	3.10	1.99	110.00	2.86	1.80	122.00	3.60	2.22
Bedding.....	57.00	1.39	0.89	37.00	0.96	0.62	27.00	0.79	0.49
Human labor.....	493.20	13.40	8.59	394.50	10.47	6.65	311.85	9.20	5.67
Horse labor.....	1.00	0.03	0.03	4.95	0.10	0.07	.....	.....	.....
Use of buildings.....	186.83	5.08	3.25	139.40	4.55	2.69	118.23	3.49	2.15
Use of equipment.....	25.93	0.72	0.45	29.10	0.79	0.49	16.00	0.49	0.30
Interest on stock.....	119.00	3.26	2.09	114.15	2.87	1.92	82.70	2.44	1.50
Interest on feed and supplies.....	37.00	1.00	0.64	32.50	0.87	0.55	21.50	0.61	0.39
Miscellaneous.....	8.00	0.22	0.14	6.00	0.16	0.10	6.00	0.18	0.11
Total costs.....	\$2,661.03	\$72.31	\$46.36	\$2,072.96	\$53.98	\$34.96	\$1,598.52	\$47.15	\$29.06
Returns:									
Manure.....	\$ 392.73	\$10.67	\$ 6.84	\$ 372.18	\$ 9.60	\$ 6.28	\$ 208.30	\$ 8.80	\$ 5.42
Appreciation.....	1,209.00	32.86	21.06	1,157.00	30.13	19.51	973.00	28.70	17.66
Amount received for service.....	46.00	1.25	0.81	66.00	1.72	1.11	36.00	0.88	0.55
Total returns.....	\$1,647.73	\$44.78	\$28.71	\$1,595.18	\$41.54	\$26.90	\$1,301.30	\$38.38	\$23.66
Difference (= cost of herd bulls kept).....	\$1,013.30	\$27.53	\$17.65	\$477.78	\$12.44	\$8.06	\$297.22	\$8.77	\$5.40
Amount paid for service.....	\$89.00	\$2.42	\$1.55	\$56.00	\$1.46	\$0.94	\$38.00	\$1.12	\$0.69
Total cost of bull service.....	\$1,102.30	\$29.95	\$19.20	\$533.78	\$13.90	\$9.00	\$335.22	\$9.89	\$6.09

is to keep higher-priced bulls, to feed them more liberally, to bed them better, and to spend more time in their care. All of this increases the cost of their keep.

When the records were sorted by the proportion of milk sold in May, June, and July, the costs and returns for herd bulls were also tabulated. The ratio of bull calves to older bulls is much the same, regardless of the proportion of milk produced in summer.

Less grain, less silage, less dry forage, and less whole milk, was fed to herd bulls when a larger proportion of the milk was produced in summer (table 137).

All of the important items of cost for herd bulls are less in the herds where summer dairying is largely practiced. Less manure is recovered, and the appreciation on bulls is also less, in those herds. But the difference between costs and returns, or the net cost of keeping bulls, is also less in summer dairies than in winter dairies. (Table 138.)

PART V. CONCERNING VEALS AND BULLS TO BE SOLD

The average number of veal calves inventoried was 16, valued at \$9.25 a head, and of bull calves being raised to be sold 22, valued at \$14.18 a head.

Only four calves were purchased to be fattened. Six bulls were bought to be sold later when partly raised. There were 937 calves to be vealed, valued at birth at \$1.76 each, and 75 bulls to be sold, valued at birth at \$4.15 each, born during the year.

On 94 farms, 368 calves were fatted and slaughtered or sold. The average value of calves fatted was \$10.57 a head. On 97 farms 546 calves were sold to be fatted elsewhere, for an average price of \$1.76 a head. These calves were sold when they were old enough to be taken away. The price received just equaled the value at birth.

In most cases no costs except for feed were obtained for veals and bulls to be sold. On a few farms some of the other costs were obtained, but it was found impracticable to endeavor to get this information for each farm. Accurate statements of the labor and other items of cost cannot be given because such costs are so small a part of those for the herd, but dependable estimates of the milk and other feed used can be furnished.

Amount and value of feed used, and miscellaneous costs and returns

The amount of milk used by bulls to be sold and that used in fattening veals was not kept separate on the records. The quantities of feed used per head were found by dividing the total amount of feed used by the total number of fat calves sold, slaughtered, or on hand plus the number of bull calves born and purchased during the year. By so doing it was found that 427 pounds of whole milk, 14 pounds of skimmilk, 3 pounds of grain and calf meal, and 4 pounds of dry forage, were used per veal or bull to be sold (table 139).

The total costs were \$7.04 a head, the total returns \$8.57 a head, and the difference \$1.53 a head. This cannot properly be called gain on calves, because the labor spent in their care, and other costs for this class of stock, were included with labor for cows.

TABLE 139. AMOUNT AND VALUE OF FEED USED, AND MISCELLANEOUS COSTS AND RETURNS, FOR VEALS AND BULLS TO BE SOLD

Number of farms fattening calves.....	94
Per cent of farms having calves to be vealed.....	69
Fat calves sold, slaughtered, or on hand.....	377
Bull calves to be sold, born and purchased during year.....	76
Total fat calves and bulls to be sold.....	453

Kind of feed	Number of pounds used	
	Total	Per head
Whole milk.....	193,535	427
Skim milk.....	6,522	14
Grain and calf meal.....	1,350	3
Dry forage.....	1,800	4
Costs:		
Whole milk.....	\$3,126.91	\$6.90
Skim milk.....	13.16	0.03
Grain and calf meal.....	23.00	0.05
Dry forage.....	11.00	0.02
Miscellaneous, and use of buildings.....	17.00	0.04
Total costs.....	\$3,191.07	\$7.04
Returns:		
Appreciation.....	\$3,876.00	\$8.56
Manure.....	4.50	0.01
Total.....	\$3,880.50	\$8.57
Difference.....	+\$689.43	+\$1.53

Size of herd and number of calves vealed

Calves fattened in larger herds are fed less milk. This, together with the fact that they are sold for less money, would suggest that they are disposed of at an earlier age. Various investigations have shown that the older a calf becomes, the more whole milk is required to produce a pound of gain. The milk used in making veal will furnish more energy than the veal it produces. Thus, from the public standpoint it is better to use the milk than to feed it to make meat.

It frequently happens that a number of cows in the herd freshen a few days apart. In such cases there is milk unfit for human use that may best be turned into money by transferring a veal calf from one cow to another. Sometimes calves fail to do well when so handled, but in the larger herds a number were fattened in this manner.

The very small herds fat a larger proportion of their veal calves than do the very large herds. This is to be expected since they follow a more extensive system. The prices received for calves sold to be fattened were higher in the larger herds. This is probably due to the size of the calf.

The relation of the size of herd to the proportion of veal calves fattened at home, the proportion sold to be fattened, and the prices received, are given in table 140:

TABLE 140. RELATION OF SIZE OF HERD TO PROPORTION OF VEAL CALVES FATTED AT HOME, PROPORTION SOLD TO BE FATTED ELSEWHERE, AND PRICES RECEIVED

Number of cows per farm	Fat calves sold or slaughtered, plus increase in inventory of fat veal calves				Calves sold to be fattened, or on hand			
	Number	Value		Per cent*	Number	Value		Per cent*
		Total	Per head			Total	Per head	
6 to 10.....	89	\$ 949	\$10.66	41	126	\$196	\$1.56	58
10+ to 14.....	132	1,450	10.98	53	106	168	1.58	42
14+ to 18.....	46	547	11.89	26	129	231	1.79	74
Over 18.....	110	1,064	9.67	37	187	372	1.99	63
All farms.....	377	\$4,010	\$10.64	40	548	\$967	\$1.76	58

*Of calves vealed or to be vealed born during the year, plus calves purchased to be vealed, 16, or 2 per cent, died after birth.

Calves vealed in three seasonal groups

The amount of milk used per veal was practically the same regardless of the season of milk production. A little more skimmilk was used in the summer dairies. The average value of milk used for veals in winter dairies was \$1.70 per hundred pounds, while in summer dairies it was \$1.52, or 18 cents less per hundred pounds. Thus, calves in summer dairies were fattened on cheaper milk, and accordingly the cost was slightly less. It is possible that in summer dairies some calves were fattened during the fall and winter, when milk was higher in price. But since this was not ascertained, it became necessary to charge milk at the average price for the year on each farm. In summer dairies, the returns exceeded the costs by \$2.76 a head, while in winter dairies the difference was only 70 cents a head (table 141).

Altho in summer dairies fewer of the calves born are deaconed or vealed, the proportion of vealed calves fattened at home is higher than in winter dairies. In summer dairies, 44 per cent of the veal calves were sold to be fattened, and 54 per cent were fattened at home; while in winter dairies, 65 per cent were sold to be fattened, and only 34 per cent were fattened at home (table 142). Inasmuch as the time of year when the calves were fattened was not ascertained, it was assumed that most of those vealed in summer dairies were fattened in the spring and most of those vealed in the fall dairies were fattened in the fall. The price received for fattened calves was

much the same regardless of the season of milk production, but the average price received for those sold to be vealed was higher in winter dairies than in summer dairies.

TABLE 141. RELATION OF SEASON OF MILK PRODUCTION TO MILK AND FEED USED BY VEALS AND BULLS TO BE SOLD

	Per cent of milk sold during May, June, and July					
	Less than 33		From 33 to 40		More than 40	
Number of farms fattening calves.....	34		33		27	
Per cent of farms having calves to be vealed.....	67		67		73	
Fat calves sold, slaughtered, or on hand.	129		139		109	
Bull calves to be sold, born and purchased during year.....	33		29		14	
Total fat calves and bulls to be sold....	162		168		123	
Kind of feed	Total	Per head	Total	Per head	Total	Per head
Whole milk (pounds).....	67,761	418	74,622	444	51,152	416
Skim milk (pounds).....	1,350	8	2,100	12	3,072	25
Grain and calf meal (pounds).....	100	1	1,250	7	.....	.....
Dry forage (pounds).....	.....	.....	.....	.....	1,800	15
Costs:						
Whole milk.....	\$1,152.41	\$7.11	\$1,197.78	\$7.13	\$776.72	\$6.31
Skim milk.....	3.00	0.02	4.00	0.02	6.16	0.05
Grain and calf meal.....	3.00	0.02	20.00	0.12	.....	.....
Dry forage.....	.....	.....	.....	.....	11.00	0.09
Miscellaneous, and use of buildings....	6.00	0.04	11.00	0.07	.....	.....
Total costs.....	\$1,164.41	\$7.19	\$1,232.78	\$7.34	\$793.88	\$6.45
Returns:						
Net increase.....	\$1,274.00	\$7.86	\$1,469.00	\$8.75	\$1,133.00	\$9.21
Manure.....	4.50	0.03	.....	.....	.....	.....
Total returns.....	\$1,278.50	\$7.89	\$1,469.00	\$8.75	\$1,133.00	\$9.21
Difference.....	+\$114.09	+\$0.70	+\$236.22	+\$1.41	+\$339.12	+\$2.76

TABLE 142. RELATION OF SEASON OF MILK PRODUCTION TO PROPORTION OF VEAL CALVES FATTED AT HOME, PROPORTION SOLD TO BE FATTED ELSEWHERE, AND PRICES RECEIVED

Per cent of milk sold during May, June, and July	Fat calves sold or slaughtered, plus increase in inventory of fat veal calves				Calves sold to be fattened, or on hand			
	Number	Value		Per cent*	Number	Value		Per cent*
		Total	Per head			Total	Per head	
Less than 33.....	129	\$1,351	\$10.47	34	244	\$455	\$1.86	65
From 33 to 40.....	139	1,521	10.94	38	217	383	1.76	60
More than 40.....	109	1,138	10.44	54	87	129	1.48	44

* Of calves vealed or to be vealed born during the year, plus calves purchased to be vealed, the remainder died after birth.

SUMMARY

The important quantities found for summer and winter dairies are summarized in table 143 in comparison with averages for all farms:

TABLE 143. SUMMARY OF QUANTITIES

	Less than 33 per cent of milk sold during May, June, and July	Average for all farms	More than 40 per cent of milk sold during May, June, and July
Size of business:			
Acres farmed.....	168	157	142
Acres pastured.....	57	53	52
Cows per farm.....	14.2	13.8	12.3
Heifers one year old or older.....	3.8	3.2	2.8
Heifers less than one year old.....	3.7	3.6	3.5
Cattle units.....	18.7	17.9	16.2
Hundredweight of milk produced per farm.....	830	764	645
Hundredweight of milk sold per farm.....	768	703	591
Season of milk production:			
Per cent of milk sold during:			
May, June, July.....	27	34	43
August, September, October.....	18	22	28
November, December, January.....	27	20	13
February, March, April.....	28	24	16
Month of maximum production.....	May	June	June
Month of minimum production.....	August	February	February
Production:			
Milk produced per cow (pounds).....	5,822	5,532	5,255
Milk sold per cow (pounds).....	5,392	5,089	4,815
Butterfat produced per cow (pounds).....	234	222	215
Butterfat sold per cow (pounds).....	217	204	197
Per cent of butterfat in milk.....	4.0	4.0	4.1
Manure recovered per cattle unit (tons).....	8.2	7.7	7.2
Feeding:			
Cows:			
Acres of pasture per animal unit.....	3.1	3.1	3.4
Grain per cow (pounds).....	1,668.0	1,407.0	1,140.0
Grain per cow per day during winter (pounds).....	7.2	6.0	4.8
Silage per cow (pounds).....	5,592.0	3,806.0	1,268.0
Silage per cow per day during winter (pounds).....	26.3	18.1	6.2
Other succulent feed per cow.....	858.0	837.0	732.0
Other succulent feed per cow per day during winter (pounds).....	1.8	1.5	1.1
Dry forage per cow (pounds).....	4,265.0	4,162.0	4,437.0
Dry forage per cow per day during winter (pounds).....	20.5	20.1	21.7
Silage per cow, farms using silage (pounds)....	*7,961.0	7,272.0	†5,845.0
Silage per cow per day during winter, farms using silage (pounds).....	*38.0	34.6	†27.6
Dry forage per cow, farms using silage (pounds).....	*3,350.0	3,237.0	†3,005.0
Dry forage per cow per day during winter, farms using silage (pounds).....	*16.1	15.5	†14.3
Dry forage per cow, no silage used.....	*5,916.0	5,167.0	†4,625.0
Dry forage per cow per day during winter, no silage used.....	*28.8	25.3	†22.7

* Less than 36 per cent of the milk sold during May, June, and July.

† 36 per cent or more of the milk sold during May, June, and July.

TABLE 143 (concluded)

	Less than 33 per cent of milk sold during May, June, and July	Average for all farms	More than 40 per cent of milk sold during May, June, and July
Heifers:			
Whole milk fed per heifer calf.....	424	375	281
Skimmilk and buttermilk fed per heifer calf.....	204	235	257
Grain per cattle unit of heifers.....	589	531	445
Silage per cattle unit of heifers.....	1,746	1,234	389
Other succulent feed per cattle unit of heifers....	31	100	171
Dry forage per cattle unit of heifers.....	3,558	3,207	3,092
Herd bulls:			
Whole milk fed per bull calf to be kept.....	456	392	325
Skimmilk and buttermilk fed per bull calf to be kept.....	118	138	194
Grain per cattle unit of herd bulls.....	720	533	417
Silage per cattle unit of herd bulls.....	2,391	1,430	481
Other succulent feed per cattle unit of herd bulls.	27	52	18
Dry forage per cattle unit of herd bulls.....	4,062	3,430	3,077
Veals and bulls to be sold:			
Whole milk fed per veal and bull to be sold.....	418	427	416
Economy of production in terms of feed:			
Per 100 pounds of milk produced during pasture season:			
Days of pasture per cow.....	7.1	6.0	5.1
Grain (pounds).....	6.2	5.2	4.3
Silage (pounds).....	6.6	2.8	0.0
Other succulent feed (pounds).....	22.0	20.2	16.4
Dry forage (pounds).....	0.6	0.5	0.4
Per 100 pounds of milk produced in winter:			
Grain (pounds).....	42.6	43.9	47.5
Silage (pounds).....	151.9	129.0	59.9
Other succulent feed (pounds).....	10.2	10.5	10.3
Dry forage (pounds).....	118.5	143.5	209.1
Feed units.....	113.8	119.8	135.0
Per 100 pounds of milk produced for the year:			
Grain (pounds).....	28.6	25.4	21.7
Silage (pounds).....	96.1	68.8	24.1
Other succulent feed (pounds).....	14.7	15.1	13.9
Dry forage (pounds).....	73.3	75.2	84.4
Labor:			
Human labor:			
Hours per cow:			
Milking.....	96.3	90.1	89.0
Hauling milk.....	16.3	19.6	23.3
Other labor.....	86.2	77.7	73.7
Total hours.....	198.8	187.4	186.0
Hours per 100 pounds of milk produced.....	3.42	3.38	3.54
Hours per cattle unit of heifers.....	52.5	55.1	54.9
Hours per cattle unit of herd bulls.....	89.4	73.0	61.3
Horse labor:			
Hours of horse labor per cow, including milk hauling.....			
Hours of horse labor per 100 pounds of milk produced, including milk hauling.....	29.8	33.9	39.1
	0.51	0.61	0.74

FINANCIAL RECORD OF A DAIRY HERD

C. U. S. N. March 42—Page 1

A blank arranged for calculating separately the costs and returns for the entire dairy herd, for cows, for heifers, for herd bulls, for calves vealed and for bulls raised to sell.
 Prepared by Department of Farm Management, New York State College of Agriculture, at Cornell University, Ithaca, N. Y.

Record for the year ending _____ 19____ Date _____ 19____ Herd number _____ Number used in tabulating _____
 Dairyman's name _____ Age _____ Post Office _____ R. D. _____ County _____ State _____
 Acres farmed _____ Acres owned _____ Acres share rented _____ Acres cash rented _____ Acres of crops _____
 Miles to milk station _____ Elevation of farm _____ feet. Located on upland or in a valley _____

HOME GROWN FEED AND BEDDING USED DURING THE YEAR BY DAIRY CATTLE

	TOTAL HERD			COWS PASTURE PERIOD		COWS WINTER PERIOD		HEIFERS		HERD BULLS		BULLS TO SELL	
	Amount	Price	Value	Amount	Value	Amount	Value	Amount	Value	Amount	Value	Amount	Value
GRAIN													
Corn													
Oats													
Barley													
Buckwheat													
SUCCULENT FEED													
Corn silage													
Mangels													
Cabbage													
Siling crops ()													
DRY FORAGE													
Corn stover													
Timothy hay													
Mixed hay													
Clover hay													
Alfalfa hay													
Rowen													
Oat hay													
Oat and pea hay													
Millet hay													
Straw fed ()													
BEDDING													
Straw ()													
Straw ()													
Other bedding ()													

*PURCHASED FEED AND BEDDING USED DURING THE YEAR BY DAIRY CATTLE

GRAIN													
Less than 12 per cent. protein													
Beet pulp													
Corn meal													
Ground oats													
Hominy													
Molasses													
Molasses feeds													
12-25 per cent. protein													
Calf meal													
Wheat bran													
Wheat feed													
Wheat middlings													
Over 25 per cent. protein													
Brewer's grains													
Cottonseed meal													
Distiller's grains													
Gluten feed													
Oil meal													
SUCCULENT FEED ()													
DRY FORAGE													
Hay ()													
Corn stalks													
BEDDING													
Straw													
Shavings													
Sawdust													
Other bedding													
TOTALS													
Grain													
Silage													
Other succulent feed													
Dry forage													
Skim milk purchased				X	X	X	X	X	X	X	X	X	X
TOTAL FEED	X		X		X			X		X		X	X
Bedding													

Average value of feed and sup. () \$ _____ Interest \$ _____ Charge: Cows \$ _____ Heifers \$ _____ Herd bulls \$ _____ Bulls to sell \$ _____
 plus kept on hand for cattle () \$ _____

*Divide pounds of wet brewer's grains by 3.8 and list as dried grain. Divide wet beet pulp by 1.9 and list as dried beet pulp. If purchased alone milk or other feed is used for much use wherever convenient.

LABOR FOR DAIRY CATTLE

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	HUMAN HOURS							HORSE HOURS					
	Total	Cows	Cows	Total	Heifers	Hard	Bulls	Total	Cows	Heifers	Hard	Bulls	to sell
Milking—Man													
Woman or child													
Feeding and care of Man, cattle, and care of animals and product													
Woman or child													
Extra time hauling feed													
Hauling bedding													
Hauling or carrying water													
Hauling sawdust for ice													
Harvesting and storing ice													
Buying, selling, and collecting feed, cattle and supplies													
Taking cows or heifers to breed													
Cleaning and whitewashing													
Herding													
Mixing feed													
Testing and accounting													
Washing suits and towels													
Other labor													
TOTAL HOURS													
TOTAL VALUE													

PASTURE

BUILDINGS USED FOR CATTLE

EQUIPMENT USED FOR CATTLE

Pasture begin _____ Bed _____ Days _____				Diversifies _____ Value Beginning _____ Value End _____				Value Beginning _____ Value End _____ Purchased Amount _____ Value _____ Cost of Repairs _____			
Number of acres pastured _____				Dairy cattle barns and yards and buildings for storing equipment used for cattle.				Cans _____			
Average value per acre \$ _____ Total value \$ _____				Sole _____ X _____				Coolers _____			
Cows	Amount	Price	Value	Milk house				Tester, bottles, etc			
Interest @ _____ %				Ice house				Milk or feed scales			
Taxes				Share of pump house				Separator			
Paid for pasture				TOTAL	\$			Churn and butter worker			
Charge for pasturing meadows				AVERAGE VALUE				Milk pails and strainers			
Posts				Cows	Amount	Price	Value	Milking machine			
Barbed wire				Interest @ _____ %	X	X		Milk wagons			
Woven wire				Insurance	X	X		Share of farm auto			
Staples				Taxes	X	X		Boilers			
Seed				Decreased value	X	X		Gasoline or steam engines			
Lime				Purchased lumber				Feed grinders			
Fertilizer				Shingles				Water pumps			
Manure hauled and applied				Roofing				Water tanks			
Man Labor				Hardware				Water heaters			
Making and repairing pasture fences				Paint				Share of other water system			
Mowing, reseeding, fertilizing and manuring pastures				Glass				Share of lighting system			
Other Man Labor				Sand				Ice tools			
Horse Labor				Gravel				Feed trucks			
Making and repairing pasture fences				Cement				Trailer carriers			
Mowing, reseeding, fertilizing and manuring pastures				Stanchions				Wheelbarrows			
Other Horse Labor				Wire setting				Clipping machine			
Other costs				Lighting rods				White washing outfit			
TOTAL COST			\$	Materials from farm				Milking tubes, milk fever, and other veterinary outfit			
DISTRIBUTION OF PASTURE COST				Carpenter's, painter's, mason's or other labor hired for building work				Baskets _____			
Stock Pastured	No.	Days Pastured	Received into in Acres, Units for the Entire Season	Per Cent of Cost to be Borne by Each	Am't Charged			Brooms _____			
Cows								Forks _____			
Heifers, 1 yr. or over								Shovels _____			
Heifers under 1 yr.								Sprayers _____			
Hard bulls								Curry combs and brushes			
Bulls to sell								Rope _____			
Animal units of other stock								Halters _____			
TOTAL	X	X		100	\$			Bull stads and rings			
Average rate paid for pasture _____				Board of this labor				Lanterns _____			
Average wages per month, including board _____				Farm labor				Calf pails _____			
				Horse labor				Milking stools _____			
				Other costs				Wash basins _____			
				TOTAL \$				Thermometers _____			
				Less increased value, if any				Labor Man—hours _____ X _____ X _____ X _____			
				TOTAL COST \$				Horse—hours _____ X _____ X _____ X _____			
				DISTRIBUTION OF BUILDING COST				Other items _____			
				Per Cent of Total Number of Cattle Units				TOTAL \$ _____ X \$ _____			
				Amount Charged				Received for equipment sold \$ _____			
				Cows _____ \$ _____				AVERAGE VALUE OF EQUIPMENT \$ _____ Interest \$ _____			
				Heifers _____				Decreased value \$ _____ Increased value \$ _____			
				Hard bulls _____				CHARGE FOR THE USE OF EQUIPMENT. Interest, purchases and repairs plus decreased value or less increased value and equipment sold \$ _____			
				Bulls to sell _____				CHARGE: Cows \$ _____ Heifers \$ _____ Hard bulls \$ _____ Bulls to sell \$ _____			

INVENTORIES, PURCHASES, SALES AND DEATHS OF DAIRY CATTLE

	Inventory at Beginning of Year			Purchased During Year			Slaughtered or Sold for Slaughter			Sold for Breeding and Production			Inventory at End of Year			Dead		Hides Sold
	No.	Price	Total	No.	Price	Total	No.	Price	Total	No.	Price	Total	No.	Price	Total	No.	No.	Value
Cows																		
Heifers, 1 yr. or over, not fresh																		
Heifers under 1 yr. to be raised																		
Calves to be vealed																		
Bull calves to be sold																		
Bull calf to be kept																		
Bulls 1 to 2 years																		
Bulls over 2 years																		

CALVES BORN DURING THE YEAR

MISCELLANEOUS COSTS FOR CATTLE

	Number	Value per Head at Birth	Total Value	Value of Hides and Carcasses	Total		Cows	Heifers	Hand Feeds	Bulls in Feed	Veals
					Amount	Value					
Heifers vealed or to be vealed		\$	\$								
Heifers raised or to be raised											
Bulls vealed or to be vealed											
Bulls to be kept											
Other bulls sold or to sell											
Calves born dead, aborted											
Calves born dead, not premature											
Heifers deacosed											
Bulls deacosed											
TOTAL											

Number of good heifers from good cows that were vealed _____ deacosed _____

Heifers that freshened during the year for the first time _____

Number _____ Average value just before calving \$ _____

Total value \$ _____ Average age at time of calving _____ months

Number of farrow cows _____

APPRECIATION OR DEPRECIATION ON CATTLE

Charge cows with inventory at beginning, purchases and heifers that freshened during the year for the first time. Credit cows sold or slaughtered, cow hides sold, and inventory at end. An excess of charges is the depreciation, or an excess of credits the appreciation on cows.

Charge heifers with inventories at beginning, purchases, and heifers born during year. Credit heifers sold or slaughtered, heifer hides at end, to get appreciation or depreciation.

Charge herd bulls with inventories at beginning, purchases, and value at birth of bull to be kept. Credit herd bulls sold or slaughtered, sales of hides and inventories at end, to get appreciation or depreciation. Do the same with bulls to sell and veals as with heifers or herd bulls, to get appreciation or depreciation.

	Appreciation	Depreciation
	\$	\$
Cows		
Heifers		
Herd bulls		
Bulls to sell		
Veals		
TOTAL		
NET		

AVERAGE INVENTORY AND INTEREST

	Number	Cattle Value	Value	Interest
		\$	\$	
Cows				
Heifers				
Herd bulls				
Bulls to sell				
Veals				
TOTAL				

MILK HAULING

	Hands	Calves	Horse
Trips			
Miles			
Man hours			X
Woman or child hours			X
Horse hours			X
Value human labor	\$	\$	X
Value horse labor			X
Amount paid @ _____ per cwt.	X	X	\$
Received for hauling milk	X	X	\$
COST OF MILK HAULING \$			
NET			\$

	Total		Cows	Heifers	Hand Feeds	Bulls in Feed	Veals
	Amount	Value					
Insurance on cattle		\$					
Taxes on cattle if any							
Condimental feeds							
Salt							
Vaseline, salves, salts and other medicines							
Disinfectants							
Tuberculin testing							
Dehorning							
Veterinary fees							
Loose killers							
Pty killers							
Tangle foot							
Lime							
Kerosene							
Carbide							
Electric lights							
Gasoline							
Oil							
Batteries for engines							
Fuel for water heater							
Fuel for dairy							
Soap and cleaning powder							
Towels, smts, straw, straw, cloths, and muslin for windows							
And							
Testing dues							
Board of tester							
Board of testers horse							
Board of cattle buyers							
Freight or express on cattle							
Feed grading							
Paid for hauling feed, bedding, ice or sawdust for ice							
Paid for ice							
Sawdust for ice							
Association dues							
Dairy papers							
Postage							
Stationery							
Printing and advertising							
Herd books or other records							
Registration fees							
Transfer fees							
Commissions, affidavits and shipping tags							
Railroad fares							
Telephone							
Telegrams							
Weighing							
Breeding fees							
Other costs							
TOTAL							

C. U. P. M. Sheet 41—Page 4

MILK AND ITS PRODUCTS SOLD

Market milk sold to	at						
Cows	Per	Pounds	Amount	Per	Price	Total	
Calving	Test	of Fat		cent		Value	
PASTURE PERIOD							
May /31							
June							
July							
August							
September							
October /31							
TOTAL							
WINTER PERIOD							
October /31							
November							
December							
January							
February							
March							
April							
May /31							
TOTAL							
TOTAL MARKET MILK SOLD							
Milk retailed							
Butter							
Cream							
Skim milk							
Butter milk							
Other milk products							
TOTAL MILK AND ITS PRODUCTS SOLD							

MILK AND ITS PRODUCTS USED ON THE FARM

	WHOLE MILK				SKIM MILK		BUTTER MILK		Butter		Cream	
	No. to which fed	Present which changed	Pounds	Value	No. to which fed	Value	No. to which fed	Pounds	Value			
Heifers										X	X	
Bulls to be kept										X	X	
Bulls to sell										X	X	
Calves vealed										X	X	
Poultry	X	X	X	X	X		X			X	X	
Hogs	X	X	X	X	X		X			X	X	
Family use	X				X		X					
Hired men	X				X		X					
TOTAL	X	X	X	X	X		X					
Price	X	X	X	X	X		X					
Total value of milk and its products used on the farm \$												
Fed cattle \$												

MISCELLANEOUS RETURNS FOR CATTLE					Total pounds of milk used		
Insurance	Total	Cows	Heifers	Bulls to sell	Total pounds of milk produced		
Premiums					Total pounds of butter fat used		
Board of cows					Total pounds of butter fat produced		
Brooding fees					MANURE RECOVERED FROM CATTLE		
Fed bags							
Other receipts					Cows	Tons	Price Value
TOTAL					Heifers		
					Hard bulls		
					Bulls to sell		
					TOTAL		

FACTORS FOR ANALYZING AND STUDYING THE RECORD

SUMMARY OF COSTS AND RETURNS							
	From Page	Total	Cows	Heifers	Hard Bulls	Bulls to sell	Yield
		\$	\$	\$	\$	\$	\$
COSTS							
Feed	1						
Milk and its products produced on the farm and fed to cattle	4	X	X				
Pasture	2						
Bedding	1						
Human labor	2						
Horse labor	2						
Buildings	2						
Equipment	2						
Depreciation on cattle	3						
Interest on cattle	3						
Interest on feed and supplies	1						
Milk hauling	3						
Miscellaneous	3						
Loss on herd bulls	4	X			X	X	X
TOTAL							
RETURNS							
Gain on herd bulls	4	X			X	X	X
Calves born during the year	3	X		X	X	X	X
Appreciation on cattle	3						
Manure	4						
Milk and its products sold on the farm*	4			X	X	X	X
Milk and its products used on the farm*	4			X	X	X	X
Miscellaneous	4						
TOTAL							
Gain							
Loss							
Returns other than milk sold							
Cost of milk at market							

*To get cost of milk at market subtract returns other than milk sold from total costs.

BREED OF CATTLE				Years pure bred bull used . . . Does dairy man weigh milk daily? . . . If not how often? . . . Was herd in cow testing association for the year of this record? (Do not include value of milk and its products used by cattle under total herd.)			
Cows	Bred	Number Registered	Average Weight	Average Yield Milk			
Heifers 1 yr. or over			X	X			
Heifers under 1 yr.			X	X			
Hard bulls			X	X			
Bulls to sell			X	X			

*A term as here used is the measure of energy in a feed, available for maintenance and production.

SIZE OF THE DAIRY ENTERPRISE				THIS HERD		AVERAGE FOR REGION	
	Amount or Number	Value or Per cent.		Amount or Number	Value or Per cent.	Amount or Number	Value or Per cent.
1. Acres farmed		X					X
2. Number of cows		X					X
3. Number of heifers		X					X
4. Milk sold	cwt.	\$				cwt.	\$
FACTORS INFLUENCED BY SIZE							
5. Labor per cow	hrs.					hrs.	
6. Labor per cattle unit of heifers							
7. Building investment per cattle unit	X				X		
8. Building costs per cattle unit	X				X		
9. Milk hauling per cow	hrs.				hrs.		
10. Milk hauling per hundred weight							
11. Total profit on dairy cattle	X				X		
SEASON OF MILK PRODUCTION							
12. Market milk sold in pasture period	cwt.	%			cwt.	%	
13. Market milk sold in winter period		%			%		%
14. Cows calving in spring months of		%			%		%
15. Cows calving in fall months of		%			%		%
PRODUCTION PER COW							
16. Milk sold per cow	lbs.	\$			lbs.	\$	
17. Milk produced per cow	lbs.				lbs.		
18. Butter fat in milk produced per cow	lbs.	X			lbs.	X	
FEEDING							
19. Grain fed cows per cow	lbs.	\$			lbs.	\$	
20. Silage fed cows per cow	lbs.				lbs.		
21. Dry forage fed cows per cow	lbs.				lbs.		
22. Value of feed except pasture per cow	X				X		
23. Per cent. of dunes in grain of winter ration (Feed containing over 15 per cent. protein)	X	%			X	%	
24. Grain per cattle unit of heifers	lbs.				lbs.		
25. Grain per cattle unit of herd bulls	lbs.				lbs.		
ECONOMY OF PRODUCTION AND PROFITS							
26. Herd cost of milk per hundred weight	X				X		
27. Cow cost of milk per hundred weight	X				X		
28. Cow cost per pound of butter fat	X				X		
29. Total costs per cow	X				X		
30. Total returns per cow	X				X		
31. Profit per cow	X				X		
32. Total cost of heifers per cattle unit	X				X		
33. Appreciation on heifers per cattle unit	X				X		
ECONOMY OF WINTER PRODUCTION							
	Per 100 lbs. of milk produced				Per 100 lbs. of butter fat produced		
Hours of labor							
Grain							
Silage							
Other succulent feed							
Dry forage							
TOTAL FEED							

